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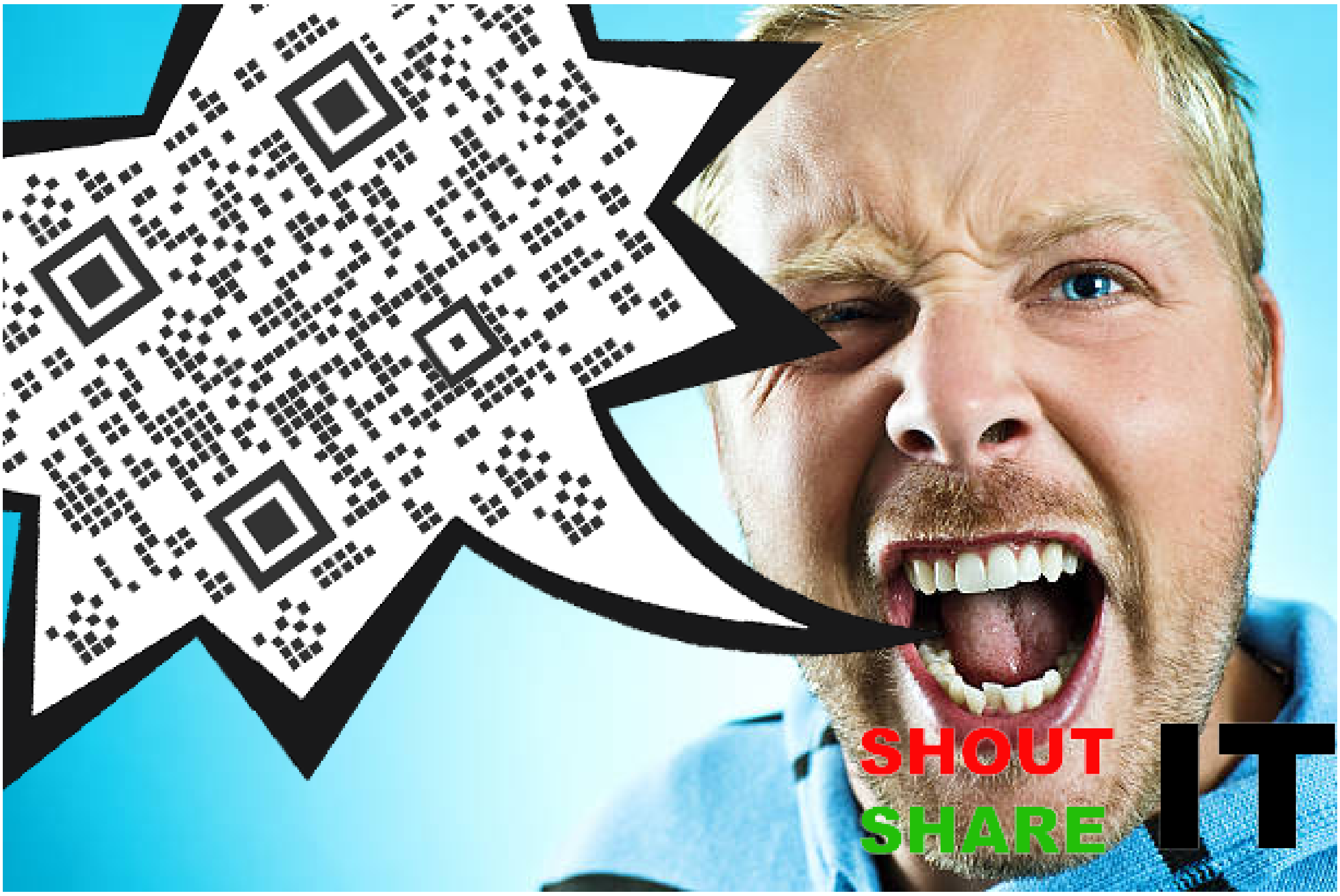
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Public Document No. 4

# FIFTY-FIFTH

# ANNUAL REPORT OF THE SECRETARY

OF THE

# MASSACHUSETTS

# STATE BOARD OF AGRICULTURE,

TOGETHER WITH THE

## TWENTIETH ANNUAL REPORT OF THE MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION.

1907.

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# STATE BOARD OF AGRICULTURE, 1908.

### Members ex Officio.

HIS EXCELLENCY CURTIS GUILD, JR.
HIS HONOR EBEN S. DRAPER.
HON. WM. M. OLIN, *Secretary of the Commonwealth.*
KENYON L. BUTTERFIELD, M.A., *President Massachusetts Agricultural College.*
C. A. GOESSMANN, PH.D., LL.D., *Chemist of the Board.*
AUSTIN PETERS, M.R.C.V.S., *Chief of the Cattle Bureau.*
F. WM. RANE, B. AGR. M.S., *State Forester.*
J. LEWIS ELLSWORTH, *Secretary of the Board.*

### Members appointed by the Governor and Council.

| | Term expires |
|---|---|
| HENRY M. HOWARD of West Newton, | 1909 |
| WARREN C. JEWETT of Worcester, | 1910 |
| CHARLES E. WARD of Buckland, | 1911 |

### Members chosen by the Incorporated Societies.

| | | |
|---|---|---|
| *Amesbury and Salisbury (Agr'l and Hort'l),* | J. J. MASON of Amesbury, | 1909 |
| *Barnstable County,* | JOHN BURSLEY of West Barnstable, | 1910 |
| *Blackstone Valley,* | SAMUEL B. TAFT of Uxbridge, | 1909 |
| *Bristol County Fair, Inc.,* | WM. N. HOWARD of South Easton, | 1910 |
| *Deerfield Valley,* | WM. B. AVERY of East Charlemont, | 1911 |
| *Eastern Hampden,* | O. E. BRADWAY of Monson, | 1909 |
| *Essex,* | FREDERICK A. RUSSELL of Methuen, | 1911 |
| *Franklin County,* | FRANK GERRETT of Greenfield, | 1910 |
| *Hampshire,* | HENRY E. PAIGE of Amherst, | 1910 |
| *Hampshire, Franklin and Hampden,* | WM. A. BAILEY of Northampton, | 1909 |
| *Highland,* | HENRY S. PEASE of Middlefield (P. O. Chester, R. F. D.), | 1911 |
| *Hillside,* | W. A. HARLOW of Cummington, | 1911 |
| *Hingham (Agr'l and Hort'l),* | EDMUND HERSEY of Hingham, | 1909 |
| *Hoosac Valley,* | A. M. STEVENS of Williamstown, | 1909 |
| *Housatonic,* | EDWIN L. BOARDMAN of Sheffield, | 1909 |
| *Marshfield (Agr'l and Hort'l),* | H. A. OAKMAN of North Marshfield, | 1909 |
| *Martha's Vineyard,* | JAMES F. ADAMS of West Tisbury, | 1910 |
| *Massachusetts Horticultural,* | WILFRID WHEELER[1] of Concord, | 1909 |
| *Massachusetts Society for Promoting Agriculture,* | N. I. BOWDITCH of Framingham, | 1909 |
| *Middlesex North,* | GEO. W. TRULL of Tewksbury, (P. O. Lowell, R. F. D.) | 1911 |
| *Middlesex South,* | ISAAC DAMON of Wayland (P. O. Cochituate), | 1911 |
| *Nantucket,* | H. G. WORTH of Nantucket, | 1909 |
| *Oxford,* | WALTER A. LOVETT of Oxford, | 1910 |
| *Plymouth County,* | AUGUSTUS PRATT of North Middleborough, | 1911 |
| *Spencer (Far's and Mech's Assoc'n),* | NOAH SAGENDORPH of Spencer, | 1910 |
| *Union (Agr'l and Hort'l),* | GEORGE O. MILLARD of Blandford, | 1910 |
| *Weymouth (Agr'l and Ind'l),* | THERON L. TIRRELL of South Weymouth, | 1909 |
| *Worcester,* | B. W. POTTER of Worcester, | 1911 |
| *Worcester East,* | W. A. KILBOURN of South Lancaster, | 1909 |
| *Worcester Northwest (Agr'l and Mech'l),* | ALBERT ELLSWORTH of Athol, | 1910 |
| *Worcester South,* | C. D. RICHARDSON of West Brookfield, | 1910 |
| *Worcester County West,* | JOHN L. SMITH of Barre, | 1911 |

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[1] Elected to fill unexpired term of Wm. H. Spooner of Jamaica Plain; deceased March 21, 1908.

# THE FIFTY-FIFTH ANNUAL REPORT

OF THE

# SECRETARY

OF THE

# STATE BOARD OF AGRICULTURE.

*To the Senate and House of Representatives of the Commonwealth of Massachusetts.*

The year 1907 has been an unusual one in the way of agricultural development. Not for years has there been so much of agitation and stirring of thought and spirit among our farming population as during the past twelve months. With this agitation, and perhaps spirit of unrest, there has been naturally a diversity of opinion as to the future of agriculture in New England, ranging from the deeply pessimistic to the hopeful outlook of the born optimist, in accordance with the nature and circumstances of the individual. There has also been considerable of accusation and denial, the clashing of partisans of different view points, into which a certain amount of apparent personal feeling has entered from time to time.

Agitation and unrest are healthy symptoms in themselves of the condition of the farmers of the State. Contentment is a dangerous state of mind, if we are to hope for progress; more is accomplished by a healthy and well-regulated discontent with conditions than by any other force in the working out of human affairs. When the day comes that our farmers are contented and satisfied with their lot and condition in life, we may look to see a decadence of the old New England spirit, and the development of a peasant class to take the place of our progressive and independent farmers.

Nevertheless, there is a necessity for calm judgment and wise action in the guidance of the spirit of progress, else will we find it running riot amongst institutions and forces established and maintained for the benefit of agriculture, tearing down instead of building up, and destroying without effort to replace. It seems, therefore, to your secretary that a careful review of the conditions of the year, both in the practical side of agriculture and the theoretical questions involved, will be an aid towards arriving at a reasonable solution of our present problems; and nowhere is there a better opportunity for the same than in this, my annual report of the work of the Board for the year just closed.

Taking everything into consideration, we find that the year has been rather below the average for profit with our farmers. Crops have not been especially good, taken as a whole; prices for farm products have been high; so have the prices of those things which the farmer has to purchase, grain, especially, reaching a point unprecedented in recent years. This has been a serious factor in striking the balance for the year, — more so than formerly, for as farming is now conducted, more and more reliance is placed on the western grains as a source of cattle and animal feed, and less is raised in Massachusetts than ever before. Indeed, it is a question whether this tendency has not been carried to too great an extreme, and if greater profit could not be secured, year in and year out, by a return in a measure to the system of general farming formerly practised.

The corn crop was much less valuable than usual, owing to the unfavorable conditions of the season, a cold, backward spring being followed by drought during the growing season, and this without any very warm weather, such as was needed to balance the low temperatures of the early summer. As a consequence, much of the crop failed to mature, and it was nearly a failure as a grain crop in some sections. Its value for ensilage was also greatly lessened by the immature condition in which it had to be put into the silo, and the value of the crop to farmers and stock feeders must have been at least a third under the normal. There was an excellent first crop of hay, but the rowen crop was very light, owing to midsummer drought, and the two crops could not have been above the normal, taken in combination.

Dairy products have brought good prices, there having been a distinct increase in the price of milk for the Boston market over previous years. This would seem, however, to have been more than balanced by the increased cost of grain and the reduced supply of roughage, as indicated from the partial failure of the corn and rowen crops, so that the net gain for the farmers was very little if anything over former years. With the extreme difficulty of securing farm help, and its high price, there would seem to be the necessity of a still further increase in the price of milk to the farmers, if the milk supply of our cities is to be maintained at the high standard already set and demanded by both the consuming public and the law-enforcing agencies of the Commonwealth. To the end that such an increase may be secured, there should be a campaign of education in the food value of milk and the cost of its production, so that the public may come to recognize the necessity of paying a fair price for a first-class product. Also, there is the duty upon the milk producers of offering such a product that the consuming public may have no reasonable ground for objection to paying the price demanded. On the one hand there must be a fair recognition of the scriptural teaching that "the laborer is worthy of his hire," and on the other a full realization that it is not good business to demand a first-class price for anything except a first-class product. The greater proportion of the supposed advance in the retail price of milk this time went to the farmers, — a great improvement over the conditions of a year ago, when four-fifths of the nominal advance of a cent a quart to the consumer was appropriated by the contractors to their own uses. This would appear to be indicative of an increased sense of responsibility to the producers on the part of the middlemen, and of a desire to deal fairly with them. In all the history of past agricultural development it has been shown that there is no possibility of the production of the fruits of the earth by corporate bodies, in the same manner that the fruits of man's ingenuity are produced. On the other hand, the farmers have never yet been able to combine successfully for the disposal of their products to the consumers without the intervention of middlemen. The greatest profit to both farmers and middlemen has come when both classes have stood ready to recognize the fact that they were mutually dependent on the other, and to deal in the spirit of fairness, with an eye to the future and not to mere temporary personal advantage. That this spirit has never reached its proper development in the handling of the milk supply of the Boston market must be admitted; both parties blame the other for this lack of mutual confidence; and they have stood in the past, and it is to be feared that they stand to-day more than ever, in the position of warring and antagonistic bodies. This is to be deplored, and I trust that it may be overcome to a greater extent in the future.

With the differences between the milk producers and the milk contractors this Board has nothing to do, in its official capacity. This is a business question, and can be settled only in a business way by the contractors in conference with the farmers or their representatives. All that the Board can do is to advise and furnish moral support for any movement looking to secure to the farmers any reasonable increase in price. The transportation of milk to market is also entirely outside the province of the Board. The Dairy Bureau of the Board is charged in a general way with the enforcement of the laws in relation to milk standards and purity of milk, but its work has always been mainly in relation to the enforcement of the laws against the sale of imitation dairy products. In so far as the Bureau has had to do with the enforcement of the milk laws, it has endeavored to enforce them in a spirit of fairness, and not arbitrarily, no prosecutions having been brought during the year except where milk has been actually adulterated by the addition of water or some preservative. All business should be honestly conducted, and the farmer can claim no special dispensation against prosecution for fraud. Milk is the one great universal food of the world. The addition of any foreign substance is a fraud on the consumer, and may also be a danger to health; therefore, the laws against such adulteration demand the strictest enforcement, and will always receive it at the hands of this Board and its agents.

The season has not been an especially satisfactory one to our horticulturists, most fruits having been rather light in yield, though prices have generally been good. The apple crop was predicted to be a very light one, but the harvesting season found the farmers and fruit growers with an unexpected number of barrels of fruit. The crop was far from an average one, but was still much better than was expected, and generally brought good prices. Peaches were practically an entire failure. Plums and pears were light crops, as also were cherries, though the latter are little grown commercially in Massachusetts. Strawberries were a light crop, owing to drought and cold weather, but generally brought good prices. Cranberries, contrary to expectation, proved a good crop, and also commanded good prices.

Probably the most serious menace to the fruit industry of Massachusetts at the present time is the San José scale. This insect pest appears to be on the increase in all parts of the State, being easily spread by birds from one tree to another and also from one orchard to another. So stealthy is it in its early ravages that often many trees are dead and dying before the orchardist suspects that he has to contend with the pest. Constant vigilance seems to be the price of a successful orchard to-day, and it is urged upon every owner of fruit trees that he familiarize himself with the appearance of the scale and be constantly on the lookout for it, both as a protection to himself and a duty which he owes to his neighbors. The Board has published an excellent nature leaflet on this and other scales, by Dr. H. T. Fernald, the State Nursery Inspector, which it will be glad to place in the hands of any owner of fruit and ornamental trees in the Commonwealth.

As usual, the market gardeners have been the most successful of any class of agriculturists during the year. Being less dependent upon the success of any one crop than any other class of tillers of the soil, they are able to retrieve the failure of one crop by extra care and attention to another. Also, they are able to secure better prices for their products in time of scarcity than are most other farmers, as they are less subject to competition from a distance, so that anything short of actual failure will usually leave them in a position to make at least a small profit. Therefore, this year they were able to meet the conditions of drought and cold weather with success, and had at least an average season for profit, as a whole.

Onions were a light crop, but brought unusually good prices, so that the growers were not in as unfavorable a position as would otherwise have been the case. Tobacco was very uneven, some fields doing finely, while others, especially where late planted, were very light and unsatisfactory. Much of the crop remains unsold, so that it is impossible to predict with any certainty the final result to the growers.

Poultry products have brought high prices throughout the year, but, with the high prices of grain and other poultry supplies, it is not probable that any more than the average profit has been obtained. Farmers in general would do well to pay more attention to their farm flocks of poultry, as there is no source of income that will respond more readily to intelligent treatment, or which is more neglected on the average farm.

There is one phase of farming in Massachusetts which I believe has not received sufficient attention in the past few years, — the breeding of dairy stock. To such an extent have the eastern and central portions of the State been given over to the production of milk for the city markets, that this particular line of industry has been almost entirely neglected in these sections. The usual process of the milk producer is to buy the best cows he can obtain in the market, milk them out and then sell them. Only a small proportion of these cows find their way back to the farms, most of them going to the butcher. In this way there is a constant purchasing of the best cows in the stock-breeding sections of Massachusetts and neighboring States, which never have another opportunity to reproduce their like, but pass out of the account with their fall below profitable production in the hands of their new owners. It seems inevitable that this must tend to a lowering of the standard of quality in the breeding sections. The constant culling over of the herds for the best for the milk-producing sections cannot but be lowering to the quality of the animals left as producers of good milking stock. It is thought quite likely that this process has had much to do with the difficulty that milk producers complain of in securing a profit from their operations. I would urge that milk producers give this matter careful attention, and consider whether it would not be well to endeavor to raise stock from their best milkers, even if it necessitated the cutting down of the amount of milk which they are able to produce for market. Indeed, it is believed that milk producers would find a greater profit, taking one year with another, in at least a partial return to general farming conditions, raising more of the grain and roughage which they use, and producing more of the stock which they need to renew their herds.

## The Milk Standard.

The last session of the Legislature was marked by an earnest, and at some times violent and ill-judged, effort to obtain a reduction in the standard of milk. This effort was first broached in the Legislature after the annual meeting of the Board, and without having previously been brought before the Board in any way. Under these circumstances the Board had no opportunity to take a position in the matter, and your secretary could not take other than an individual position on a matter of so much importance, without definite instructions from the Board. That any standard must be an artificial one is of course admitted, and until we are able to do without a standard at all, which time is not yet, any standard adopted will be only an imperfect measure of the quality and purity of the milk supply. That there is too wide a variation between the summer and the winter standard is, I think, too plain for argument. There is a certain amount of variation in the milk solids and fat of summer and winter milk, but it has been shown not to reach the extent of 1 per cent in the solids and ½ per cent in the fat. This variation of the standard from the actual conditions should unquestionably be done away with, so far as possible. Probably the best means to this end would be the reduction of the winter standard half of 1 per cent on the solids, with a corresponding decrease in the fat content required. Massachusetts has now the highest winter standard of any State in the Union except New Hampshire, and Minnesota and Michigan are the same; and it would seem as if no harm could result from a lowering of the standard in respect to winter milk to something approaching that for summer milk and that prevailing in other States, and that at the same time a certain amount of good would be accomplished by doing away with what is in the main a purely arbitrary differentiation between the standards for the different seasons. With such lowering there would doubtless remain certain herds that would fall below the legal standard in either fat content, total solids, or both. The milk from these herds is none the less a pure and wholesome article, claimed by many authorities to be superior as a food for infants to milk containing more butter fat, but would, under present conditions, be barred from our markets unless mixed with the milk of other cows containing more than the required amount of fat and total solids. It is to be regretted that any man-made law can shut from the market a pure and wholesome article of food. There seems to be no reason why the producer should not be allowed to sell such milk, under a guarantee of fat content, or of fat content and total solids, to any person who wishes to buy it, having full knowledge of its actual analysis, under such guarantee. It seems to me that the present milk standard law might very well be changed by the addition of a clause allowing the sale of milk under a printed guarantee of fat content, or of fat content and total solids, if that seems wiser; the same to appear upon each receptacle in which the milk is sold or conveyed. I would therefore recommend that the Board place itself squarely on record, advocating a change in the law in relation to the milk standard in these two particulars. If it should seem to the Board that such is not the wisest course, the secretary will of course bow to its decision; but he has reached these conclusions after a somewhat exhaustive study of conditions, and certainly hopes that they may seem worthy of adoption by the Board.

## Changes in the Board.

The Board lost one of its oldest, both in point of age and continuous service, and valued members by death during the year, Quincy L. Reed, delegate from the Weymouth Agricultural and Industrial Society, passing away after a short illness. Theron L. Tirrell of South Weymouth was elected to fill the vacancy.

Changes in membership resulting from elections by the several societies will be given in the report of the committee on credentials in the proceedings of the annual meeting. Members retiring because of expiration of term of service are: E. P. Williams of the Deerfield Valley Agricultural Society; John M. Danforth of the Essex Agricultural Society; Ralph M.

Porter of the Hillside Agricultural Society; Walter D. Ross of the Worcester Agricultural Society; and J. Harding Allen of the Worcester County West Agricultural Society.

Two of the members appointed by the Governor, Hon. Wm. R. Sessions of Springfield and General Francis Henry Appleton of Peabody, resigned their positions on the Board. The vacancies thus caused were filled by the appointment of Charles E. Ward of Buckland and Henry M. Howard of West Newton.

Two societies, the Bristol County and the Middlesex North, held fairs during the year, and are entitled to delegates on the Board for the ensuing year, William N. Howard of South Easton and George W. Trull of Tewksbury having been respectively elected to represent these societies.

## MEETINGS OF THE BOARD.

On June 25, 1907, the Board held a summer field meeting on the grounds of the Housatonic Agricultural Society, at Great Barrington, with the usual demonstration work, which has proved itself so popular in recent years, as the feature of the meeting. This meeting was held in this locality to the end that the farmers of Berkshire County, who had not previously been afforded a convenient opportunity to attend one of these meetings, might participate with those of other sections in the benefits arising from them. The attendance was of more local character than at previous meetings, owing to the place of meeting and the difficulty of reaching it by train from a distance without coming the night before, and, while very gratifying from a local standpoint, was not up to that afforded the meetings previously held in other sections.

On Aug. 13, 1907, a second field meeting for the year was held on the grounds of the Worcester Agricultural Society, at Worcester. The day was an unusually warm one, the meeting followed a week very full of attractions for the farmers, and the attendance was hardly what had been hoped for; nevertheless, a very fine programme was presented, including three entirely new demonstrations.

The public winter meeting for lectures and discussions was held at Boston, at the hall of the Massachusetts Horticultural Society, on invitation of that body. The addresses and discussions were excellent alike in matter and method of presentation, and will be included as usual in the annual report of the Board. The weather was in the main excellent, and the attendance should have been much larger than it was. It did not prove a disappointment, past experience showing that Boston is very apt to prove a disappointing place to hold such a meeting, from the standpoint of attendance, and in addition those present seemed to be moved to an unusual degree by a genuine spirit of inquiry and progress. The meeting was opened by Governor Guild, in his double official capacity as Governor of the Commonwealth and President of the State Board of Agriculture. A very interesting feature of the meeting was the visit to the market-garden farm of Hon. W. W. Rawson, and later to the barn of the Walker-Gordon Company at Charles River. A goodly number of members of the Board and others attending the meeting availed themselves of the opportunity to inspect these interesting and successful plants.

The annual business meeting of the Board was held at Boston, Jan. 7 and 8, 1908, and special business meetings were held at both summer meetings and at the winter meeting. The minutes of these meetings, with reports of committees, will be included in this volume.

## Agricultural Societies.

Those societies that held their annual exhibition on the first week of September were met with a downpour of rain such as has seldom been experienced at this season of the year, and which put an effectual damper on their success from a financial standpoint. Such experiences are to be expected, and it is the part of wisdom for all societies to discount their occurrence, and to be so prepared in a financial way that it will be only a mere temporary check on the well-being of the society. Generally speaking, the societies holding their fairs at earlier or later dates enjoyed very favorable weather conditions. As a rule the exhibitions were unusually well attended, and were successes from both the financial and the artistic and educational side.

It is to be questioned if there are not some societies whose premium lists stand in serious need of revision. The agriculture of the State has changed materially during the past twenty years, and in some sections the old interests have dropped out of sight, or nearly so, and new ones have arisen to take their places. For instance, cattle raising and breeding has declined materially in importance in eastern sections, with a more than corresponding interest in the importance of market gardening, fruit growing and poultry raising. Those having the duty of making up the premium lists of the societies should study carefully their local conditions, and should endeavor to offer the bulk of the premium money in such a way as to encourage those lines of agriculture which appear to be best adapted to their sections. It is obviously unjust that the bulk of the money for premiums should go to the cattle raisers in sections given over to market gardening and fruit raising; but I fear that such is too often the case. It is recommended that the Board take the premium lists of the societies a little more directly under its control, and that a committee be appointed to consider the make-up of these lists during the current year, with a view to establishing certain requirements, if it seems best, in their judgment, to which the societies shall be held in the future.

A new feature of the fairs was a demonstration at that of the Blackstone Valley Agricultural Society of the selection of cattle for breeding and the dairy, and of the grafting, budding and pruning of fruit trees. These demonstrations were so managed as not to conflict with other features of the fair, and were witnessed by practically the entire number of those in attendance on the grounds. They formed an interesting and valuable feature from an educational standpoint, particularly when the large number of young people in attendance is witnessed. The Board has received an increase in its appropriation for "the dissemination of useful information in agriculture," which will allow us to furnish such demonstrations to a limited number of societies, where it shall seem that they can be properly put before the public, and where we can be guaranteed that they will be given a clear field in the matter of conflict with other numbers on the programme. By no means all the societies can be so favored in any one year, and, other things being equal, preference will be given to those first making application for such demonstrations.

Such demonstrations would form an inexpensive feature of the programme of any society, and we shall be glad to advise with the officers of a society caring to put on such a feature at its own expense, and we are in a position to give them valuable information as to the subjects that are susceptible of practical demonstration and as to those who are most competent to handle them.

### Farmers' Institutes.

The institute work was conducted on practically the same lines as in former years, and met with equal success. We shall be able to strengthen it in various ways during the coming year, as the appropriation for the "dissemination of useful information in agriculture," from which the institute expenses are paid, has been increased from $3,000 to $4,000. This increase was in force for 1907, but came so late in the session of the Legislature that little new work could be arranged for the year. During the coming season we shall be able to supply the societies with more meetings than in the past, if there is a demand for them, and shall also be able to pay the expenses incident upon the speaker delivering a second address, where the societies desire to hold two sessions. This expense has formerly been borne by the societies, and we feel that this has doubtless deterred many of them from holding two-session institutes, with dinner or lunch in the intermission, which is believed to be the ideal institute, both from an educational and a social standpoint.

We were unable to arrange many circuits of meetings during the year 1907, having been disappointed in securing the speakers we desired. Prof. C. L. Beach of Vermont and Dr. Geo. M. Twitchell of Maine were secured for two circuits, and very satisfactory results came from their presence and work in the State. We are endeavoring to arrange at least three circuits for this season, but as yet have only secured Dr. Geo. M. Twitchell of Maine and Prof. Alfred G. Gulley of Storrs Agricultural College. Professor Gulley is a new man to our farmers, but has an exceedingly fine reputation as an up-to-date and interesting speaker on horticultural lines. Dr. Twitchell is too well known to require introduction.

One hundred and twenty-seven meetings have been held during the year, with 156 sessions. All the societies represented on the Board held 3 or more meetings, with the exception of the Hoosac Valley Agricultural Society, which held but 2 institutes, through an unexpected failure of arrangements for the third one, and the Massachusetts Society for Promoting Agriculture, which is not required to hold institutes, being represented on the Board by special enactment. Six societies held 4 or more institutes, while 19 meetings have been held in sections not covered by societies represented on the Board, and under the direction of other agricultural organizations.

The average attendance for the year shows a falling off from the last two years, being only 118 per session, as against 127 in 1906 and 125 in 1905. It is, however, considerably greater than in any other year, the figures being 109 for 1904, 102 for 1903, 104 for 1902, 107 for 1901, 91 for 1900 and 94 for 1899. At 4 of the sessions the attendance was 400 or more; at 2, from 300 to 399; at 14, from 200 to 299; at 53, from 100 to 199; and at the balance it was less than 100.

With the increase of the appropriation for the present year more institutes will be held, more speakers from a distance be secured, and a certain amount of demonstration work introduced into these meetings where considered practicable and desirable. The demand for this class of work has always been in excess of our ability to supply it, but it may be that for a year or two we shall be in the position of being able to grant any reasonable request. It is important that the agricultural societies and the farmers generally should show themselves willing to do their part in strengthening the work, to the end that the Legislature may see that the appropriation is the most valuable of any of those made for the benefit of agriculture, and be willing to grant reasonable future increases if it becomes necessary to ask for them.

On Nov. 12 and 13, 1907, your secretary attended the annual meeting of the National Association of Farmers' Institute Workers, at Washington, D. C. The meeting was a very interesting one, being attended by those in charge of the institute work in most of the States, and also delegates from the various Provinces of Canada. Your secretary furnished a paper on "The field institute; its value, methods of organizing and conducting." The programme of the meeting was exceedingly full, and gave rise to a great deal of interesting discussion in regard to the various phases of these popular meetings.

## Nursery Inspection.

The law in relation to the work of the Nursery Inspector was amended by the Legislature of 1907, so as to give that official, working under the supervision of the Board, much broader powers than those which he had formerly possessed. By this act he was given the power to appoint three additional deputy inspectors, making the total number which may be employed six. The law in relation to nursery stock coming into the State was strengthened by making it a misdemeanor for any transportation company or individual to transport or accept for transportation any nursery stock not bearing a certificate of inspection. The principal new feature of the law, as amended, is the authority given to declare any insect pest or plant disease a public nuisance, and further to allow owners of trees, plants, etc., to file complaints with the Nursery Inspector in case their trees and plants are endangered by the presence of insect pests on the trees or plants of their neighbors. The inspector may then, after examination, if he finds that there is a dangerous condition existing, compel the owner to abate the nuisance according to methods prescribed by the Nursery Inspector. There is provision for appeal from the decision of the Nursery Inspector to the secretary of the State Board of Agriculture; and in case the secretary sustains the position of the inspector, the latter may cause the nuisance to be abated, and if the owner refuses to abate it may go upon the premises of the owner and himself do the necessary work. Necessary fines are provided for the failure of citizens to comply with the provisions of the law.

These amendments have been in force only during a portion of the year, and there has not been any great amount of work done under them as yet. That they form excellent punitive restrictions upon the too common practice of many owners of trees and shrubs, of allowing their premises to become breeding grounds for insect pests, to the great detriment of their neighbors, cannot be doubted; and it is to be hoped that the citizens of the Commonwealth will avail themselves to the necessary extent of the privileges and rights placed in their hands by this remedial legislation.

The report of the Nursery Inspector is included in this volume, and will be found to contain a very full statement of the vast deal of excellent work done during the year. That this work is being carried on with great efficiency is the belief of your secretary. I have no recommendations looking to new action or legislation during the present year, as I believe that sufficient time should be given for the trial and working out of the law as it now exists, and so far as can be seen there is no further authority required at present.

## Dairy Bureau.

Much excellent work has been done by this department of the Board. The number of violations of the oleomargarine laws has somewhat increased during the year, owing to the high price of butter and the increase in the number of dealers handling uncolored oleomargarine; while the violations of the law in relation to renovated butter are less numerous than formerly, the margin of profit on renovated butter not having been sufficient during the past year to tempt dealers to take any long chances in the violation of the law. More inspections have been made than in any previous year, and a vast amount of investigation work, of great value from an educational and research standpoint, has been carried on. The details of the work appear in the report of the general agent, which is printed elsewhere in this volume. The general agent, Mr. P. M. Harwood, received a well-deserved increase in salary at the hands of the last Legislature, — a compliment to the work of the Bureau, and an act of simple justice to a hard-working and conscientious official.

## Cattle Bureau.

The report of the Chief of the Cattle Bureau will be found printed elsewhere, and is submitted without comment, the law, which makes the Bureau nominally a Bureau of the Board of Agriculture, not giving the Board or its secretary any authority in the premises.

## State Forester.

The State Forester has carried on his work during the year in a manner worthy of commendation. He has at all times been ready to co-operate with the Board, and has availed himself of our assistance in many ways. The appropriation for this work was materially increased by the Legislature of 1907, and the work has been amplified to a considerable degree over that formerly undertaken by the State Forester.

## MASSACHUSETTS AGRICULTURAL COLLEGE.

The work of the Massachusetts Agricultural College shows a gratifying rate of progress, both in quantity and quality. The number of students regularly in attendance in the four-year course shows an increase over any previous year, while the installation of the summer school of agriculture has done much to popularize the work of the college, and to acquaint the teachers of the State with the possibilities of the institution. If this summer school work develops as it bids fair to do, I do not doubt but that we shall see a marked effect in the more favorable attitude of the teaching forces in our high schools, in all probability leading to an increased number of those who go from these schools to the college for their higher education.

The greenhouses now on the grounds have been in use for over forty years, and are no longer proper buildings either for purposes of economic production or for teaching purposes. An entire new set of glass houses is needed, if the college is to give proper instruction in the line of work in which Massachusetts stands pre-eminent among the States of the Union. This has been asked of the last two Legislatures, and has each time been postponed for what seemed more pressing needs. It seems as though the time had come when the greenhouses should have the right of way in the legislative appropriations. There are of course many other things needed at the college, if it is to continue to properly grow and develop; and it is recommended that this Board favor all reasonable appropriations for increased efficiency in instruction at the college, with particular emphasis upon the necessity of the greenhouse work being properly provided for.

## THE GYPSY AND BROWN-TAIL MOTHS.

The work of suppressing the gypsy and brown-tail moths has been carried on during the year on the same lines as since the resumption of work against these insects. We are confident that all has been done that is possible to be done; but the increased expense over ten years ago, when the work of the Board was at its most efficient point, the greatly increased territory infested, and the fact that nothing can now be hoped for in the way of extermination, all show what a terrible mistake was made by the Legislature which stopped the work and allowed these insects free sway. The appropriation from the United States government was increased from $82,500 to $150,000, showing that the national authorities are fully alive to the importance of the work and the danger to be feared from the unrestricted spread of these insects. The report of the committee on gypsy moth, insects and birds will be laid before the Board in due course of business, and there is nothing which I care to add at this time.

## Crop Reports.

The publication of the monthly crop reports, for the six months from May to October, was carried on along the usual lines. The special articles printed in these reports were: "Corn as a grain crop in Massachusetts," by Prof. Wm. P. Brooks; "Plum culture in Massachusetts," by Prof. F. A. Waugh; "Hatching and rearing of chicks by natural methods on the farm," by John H. Robinson; "Bee keeping: some suggestions for its advancement in Massachusetts," by Burton N. Gates, A.M.; "Statutory bird protection in Massachusetts," by Edward Howe Forbush; and "Greenhouse pests and their control," by H. T. Fernald, Ph.D. Individual requests for these reports continuing unabated over former years, the edition was increased from 4,700 to 4,900 during the year. Most of the editions are practically exhausted, and reprints of the special articles will be issued with the publication of the annual report. Five hundred extra copies of the report for September, containing Mr. Forbush's article on "Statutory bird protection in Massachusetts," were issued, and proved insufficient to meet the demand. Suggestions as to timely articles for these reports will always be appreciated, as we desire to maintain this line of work at the highest point of efficiency.

## PUBLICATIONS.

The following publications were issued by this office in 1907, most of which may be obtained on application: —

| | Pages. | Number. | Date of Issue. |
|---|---|---|---|
| Agriculture of Massachusetts, 1906, . | 753[1] | 15,000 | Aug. 5. |
| Useful Birds and their Protection, . | 457 | 5,000 | March 13. |
| Useful Birds and their Protection, second edition. | 457 | 5,000 | Dec. 14. |
| Arbor Day, 1907, . . . . . | 32 | 3,500 | April 22. |
| Farmers' Institute Pamphlet, . . | 16 | 800 | Jan. 2. |
| Crop Report No. 1, . . . . . | 40 | 4,800 | June 10. |
| Crop Report No. 2, . . . . . | 40 | 4,900 | July 8. |
| Crop Report No. 3, . . . . . | 40 | 4,900 | Aug. 7. |
| Crop Report No. 4, . . . . . | 40 | 5,000 | Sept. 11. |
| Crop Report No. 5, . . . . . | 40 | 5,400 | Oct. 8. |
| Crop Report No. 6, . . . . . | 40 | 4,900 | Nov. 11. |
| Nature Leaflet No. 7 (reprint), . . | 4 | 1,000 | Sept. 17. |
| Nature Leaflet No. 12 (reprint), . | 6 | 1,000 | Oct. 23. |
| Nature Leaflet No. 17 (reprint), . | 6 | 1,000 | Sept. 17. |
| Nature Leaflet No. 19 (reprint), . | 6 | 1,000 | Sept. 17. |
| Nature Leaflet No. 20 (reprint), . | 8 | 1,000 | Sept. 17. |
| Nature Leaflet No. 21 (reprint), . | 4 | 1,000 | Sept. 17. |
| Nature Leaflet No. 33 (reprint), . | 6 | 1,000 | May 31. |
| Farmers' Institute Pamphlet, . . | 16 | 800 | Dec. 24. |

[1] Including nineteenth annual report of the Massachusetts Agricultural Experiment Station, 218 pages.

There were also issued in pamphlet form the following excerpts from the "Agriculture of Massachusetts," 1906: "Plant diseases," by Prof. L. R. Jones; "Fruits for local markets," by Mr. J. H. Hale; "Early agricultural education in Massachusetts," by Mr. F. H. Fowler; "The home garden," by Prof. F. W. Rane; "Clovers: their value, characteristics of varieties and methods of production," by Prof. W. P. Brooks; "Cranberry culture," by Mr. Lucian J. Fosdick; "Peach culture," by Prof. F. A. Waugh; also the annual reports of the chief of the Cattle Bureau, the Dairy Bureau, and the State Nursery Inspector.

## Nature Leaflets.

The work in this line has been the reprinting of leaflets in order to be able to fill sets. During the year leaflets Nos. 7, 12, 17, 19, 20, 21 and 33 have been revised and printed in a second edition.

## Arbor Day Pamphlet.

The pamphlet "Arbor Day, 1906," met with such an appreciative reception that it was deemed expedient to continue the publication another year.

The issue was increased to 3,500 copies, and arrangements were made, as last year, to place most of the copies in the public schools. This was made possible through the courtesy of the secretary of the State Board of Education.

The pamphlet contained 32 pages, three full-page half-tones and other illustrations. The cover design was from the pen of Mr. Philip Lyford. The Arbor Day Proclamation of His Excellency Governor Guild was inserted as a folder.

Short articles on "Need of an Arbor Day in Massachusetts," by State Forester Rane; "Forestry work of the women's clubs," by President Helen A. Whittier; "How to protect trees from insects," by State Nursery Inspector Fernald; "Why children should be friends of the birds," by Ornithologist Edward H. Forbush; and "Information — selections — suggestions," by Mrs. Stiles and Mrs. Frost of the forestry department, State Federation of Women's Clubs, made up the body of the pamphlet.

## LEGISLATIVE APPROPRIATIONS: BOARD OF AGRICULTURE.

| OBJECTS FOR WHICH APPROPRIATED. | 1907. | | 1908. |
|---|---|---|---|
| | Appropriated. | Used. | Appropriated. |
| Bounties to societies, | $18,600 00 | $16,921 54 | $18,600 00 |
| Salaries of secretary and clerks, | 6,200 00 | 6,200 00 | 6,200 00 |
| Travelling and necessary expenses of Board, | 1,500 00 | 1,277 76 | 1,500 00 |
| Lectures before the Board, etc., | 700 00 | 544 94 | 700 00 |
| Dissemination of useful information in agriculture, | 4,000 00 | 3,338 84 | 4,000 00 |
| Travelling and necessary expenses of the secretary, | 500 00 | 276 20 | 500 00 |
| Incidental and contingent expenses, including printing and furnishing extracts from the trespass laws, | 1,100 00 | 1,031 61 | 1,100 00 |
| Printing 15,000 copies of "Agriculture of Massachusetts," | 5,800 00 | 5,885 45[1] | 6,000 00 |
| Work of the Dairy Bureau, including salaries, | 8,800 00 | 8,800 00 | 9,800 00 |
| State nursery inspection, | 2,000 00 | 1,618 35 | 2,000 00 |
| Report on "Useful birds and their protection," | 6,493 11[2] | 3,993 11 | 2,500 00[3] |
| State Ornithologist, | – | – | 1,000 00 |
| Totals, | $55,693 11 | $49,887 80 | $53,900 00 |

[1] Deficiency of $85.45.

[2] Including unexpended balance of $2,459.81.

[3] Unexpended balance.

The Legislature of 1907 also appropriated $70,000 to be expended by the Chief of the Cattle Bureau of the State Board of Agriculture for exterminating contagious diseases among horses, cattle and other animals; also, $14,500 for salaries and expenses connected with the office of the Cattle Bureau, including inspectors of animals, and $8,432.60 to meet the deficiency in appropriations for the year 1906. There was appropriated also for salaries and expenses connected with the State Forester's office the sum of $10,000.

## Conference on Rural Progress.

A delegate conference on rural progress was held in the office of the Massachusetts State Board of Agriculture, Boston, on March 8, 1907, with sessions at 9.30 A.M. and 2 P.M.

The idea of this conference originated with President Butterfield of the Massachusetts Agricultural College, and was attended by delegates from all the New England States, representing State departments of agriculture and education, agricultural colleges and experiment stations, federations of churches, granges, etc.

The object of the conference was to discuss some of the rural problems in New England, and to provide for future work. Various phases of the subject were discussed by the delegates present.

An organization was perfected by the choice of Secretary Ellsworth as chairman and Prof. William D. Hurd of the University of Maine secretary.

Section meetings of the delegates from the various bodies were held at the United States Hotel, Boston, on the evening of March 7. Thirty-five delegates were recorded as being in attendance at the conference.

## Extracts from the Trespass Laws.

The law providing for these printed trespass extracts makes it the duty of the secretary of this Board "to cause copies of said extracts to be printed on durable material, suitable to be affixed to trees or otherwise to be posted in the open air," and "to furnish not exceeding five copies in any one year without charge to any reputable person applying therefor, and annually, on or before the first day of April, to send a copy to each post office in the Commonwealth."

The demand for the extracts shows a decided falling off as compared with the previous year, as is shown by the following table: —

| MONTHS. | Copies sent. | | |
|---|---|---|---|
| | 1905. | 1906. | 1907. |
| January, | 17 | 124 | 71 |
| February, | 17 | 108 | 12 |
| March, | 84[1] | 225[1] | 77[1] |
| April, | 370 | 490 | 431 |
| May, | 358 | 555 | 382 |
| June, | 253 | 314 | 281 |
| July, | 254 | 467 | 377 |
| August, | 292 | 352 | 203 |
| September, | 201 | 285 | 219 |
| October, | 210 | 343 | 211 |
| November, | 113 | 135 | 114 |
| December, | 65 | 70 | 61 |
| Totals, | 2,234 | 3,468 | 2,439 |

[1] The number of paper copies sent to post offices averaged about 900.

## Legislation.

The legislation of 1907 having reference to the Board of Agriculture or to the agricultural societies were: "An Act making appropriations for salaries and expenses in the office of the State Board of Agriculture, and for sundry agricultural expenses" (chapter 60); "An Act to establish the salary of the general agent of the Dairy Bureau of the State Board of Agriculture" (chapter 401); "Resolve in addition to a Resolve to provide for preparing and printing a special report on the birds of the Commonwealth" (chapter 17); "A Resolve to provide for printing additional copies of the report on the birds of the Commonwealth" (chapter 77); "An Act to invest the Bristol County Fair, Incorporated, with the rights and privileges of the Bristol County Agricultural Society" (chapter 288); "An Act relative to the sale or mortgage of the real estate of incorporated agricultural societies" (chapter 189); "An Act making an appropriation for exterminating diseases among horses, cattle and other animals" (chapter 123); and "An Act relative to authorizing the State Board of Agriculture to appoint a State Nursery Inspector, and to provide for the protection of trees and shrubs" (chapter 321).

## Useful Birds and Their Protection.

This book, prepared by and published under the direction of Mr. Edward Howe Forbush, Ornithologist to the State Board of Agriculture, was authorized by the Board at its annual meeting, Jan. 11, 1905, and was provided for by chapter 51 of the Resolves of the same year. This resolve provided "that there be allowed and paid out of the treasury of the Commonwealth a sum not exceeding three thousand dollars for preparing and printing, under the direction of the State Board of Agriculture, in an edition of five thousand copies, a special report on the birds of the Commonwealth, economically considered, to include the facts relating to the usefulness of birds and the necessity for their protection, already ascertained by the ornithologist of the State Board of Agriculture."

This book, containing 457 printed pages, a colored frontispiece of the wood duck, now in danger of extermination, 40 full-page half-tones and 171 additional illustrations, was received from the printers March 13, 1907. Briefly stated, the volume contains chapters on the utility of birds in nature, the value of birds to man, the utility of birds in woodlands, birds as destroyers of hairy caterpillars and plant lice, the economic service of birds in the orchard, song birds of orchard and woodland, songless birds of orchard and woodland, the utility of birds in field and garden, birds of field and garden, birds of the air, birds of marsh and waterside, checks upon the increase of useful birds, the protection of birds, and a comprehensive index.

The Resolve provided for a double distribution of the books. The Secretary of the Commonwealth received approximately 1,900 copies, to be distributed to free public libraries, high schools, certain other libraries, to certain executive officers and to members of the Legislature of 1905. The balance, approximately 3,100 copies, were delivered at the office of the secretary of the State Board of Agriculture, to be distributed under the direction of said Board. As this distribution was necessarily free in character, books were available for a very limited period only. They were reserved, however, to some extent for persons identified with "bird work," and who had in one way or another been of service to the Ornithologist of the Board of Agriculture in the performance of his duties. In spite of this effort, many such persons, as well as libraries and educational institutions, had to go on the waiting list for a second edition, which it was presumed would be authorized.

The Legislature of 1907 provided for this second edition by chapter 77 of the Resolves of that year, the edition to number 5,000 copies. Provision was made for supplying each member of the Legislature with 10 copies of the book. It was further provided that "Copies may be sold by the secretary of the State Board of Agriculture at a price not less than the cost thereof, and additional copies may be printed for sale at the discretion of the secretary, the expense thereof to be paid from the receipts from such sales. Any amount received from sales shall be paid into the treasury of the Commonwealth."

Twenty-one hundred copies of the second edition were placed at the disposal of the secretary of the State Board of Agriculture on December 17, at which date applications for approximately 1,900 copies had been filed. These persons were notified by circular letter that the second edition was available, and that the cost price had been fixed at $1. By the end of the month many of the books had been disposed of, and nearly $800 turned into the State treasury as proceeds of sales made.

The great popularity of this work shows that it fills a recognized want of the people of the State and nation. Nothing in relation to bird lore has been published anywhere which treats the subject from such a rational standpoint, and in a manner at once novel and sensible. The importance of bird study and knowledge is now being appreciated to something like its full value. Much work remains to be done in study and investigation along economic lines, in order that farmers and others may be informed as to the great value of birds to the community, and in special cases as to the best means of perpetuating and increasing them. The time has come when the position of State Ornithologist should be established, if this work is to be properly carried on. Mr. Forbush has very generously given his time for the past fifteen years to doing this work for the Board. Further demands upon him would be in the nature of an imposition, and it seems that the State could very well recognize his valuable services, and insure their continuance, by the establishment of such an office, to be filled by the State Board of Agriculture. It is therefore recommended that the Board instruct its secretary to prepare a bill providing for the establishment of the office of State Ornithologist, to be elected by the Board of Agriculture, with a small appropriation for expenses and per diem compensation, and to present the same to the Legislature and urge its passage. The need of the work being placed on a permanent basis will be seen the more clearly when it is known that there is no work being done on birds by the Agricultural College, the experiment station or any other official body. The nearest approach to official work has been the unpaid work of Mr. Forbush as Ornithologist to this Board.

Respectfully submitted,

J. LEWIS ELLSWORTH,
*Secretary.*

Boston, Jan. 7, 1908.

# SUMMARY OF CROP CONDITIONS, 1907.

May was cloudy and unpleasant, with several light to severe frosts. Pastures and mowings wintered well, and started slowly, owing to cold weather, but with the seasonal rains promised well for the future. The apple bloom was an average one for an off year, but pears and plums made a light bloom, cherries a fair bloom and peaches a very light one. Small fruits and berries bloomed well. Little damage from frost was reported. Few insects appeared. Planting progressed slowly, owing to the late season and cold weather. Farm help was unusually scarce; average wages, $22 per month with board, with $1.50 per day as the minimum without board. The acreage of cultivated crops seemed certain to be somewhat reduced, the reduction being most marked in corn and potatoes, owing to scarcity and high price of help.

Insects were not plenty during June, and did little damage. Indian corn was late, being late in planting, and very backward and uneven, owing to failure to germinate in many cases, but of good color. Haying had not commenced at time of making returns, with a good crop expected except in the hill towns, where it was said to be thin and light. There was about the usual acreage of early potatoes, but they were very backward and uneven. Early market-garden crops were much later than usual, with very little coming into the market in June. The flow of milk was well maintained, with prices generally better than in former years. Dairy cows were in fair supply, with good ones bringing higher prices. Pastures were generally in good condition, but needing rain. Strawberries were very late, but promised a fair crop; practically no peaches; currants promised well; pears and plums light; apples set well, but late; cranberries late in blooming.

Insects were less troublesome and numerous than usual in

July. Indian corn was growing very rapidly, but much later than usual. Haying was not entirely completed, and the crop was generally reported to be above the average, and of excellent quality. There was perhaps a slight falling off in the acreage of forage crops. Market-garden crops were late, but yielding well, and bringing average prices. Potatoes were late and not very promising. Apples promised only a light crop; quinces good; grapes promising; cranberries bloomed very full, but rather backward. Pastures were dry and brown in southeastern sections, but green and growing elsewhere. Rye, oats and barley were about normal crops.

Indian corn came forward rapidly during August, but further warm weather was still essential to its maturing. It suffered somewhat from dry weather during the month. Rowen promised only a very light crop, owing to dry weather. Late potatoes promised only a light crop, with some blight and rot. There was about the same acreage of tobacco as in 1906, but the crop was backward and unpromising, though early fields were in good condition. Pastures were in very poor condition, especially in eastern sections. Apples were small and backward, and had dropped badly. Oats were an average crop, but late-sown barley was making little progress. Root crops were reported as grown in eastern sections for the market, but only to a limited degree for stock feeding in any section.

The rains and warm weather of September benefited corn materially, and a fair crop was in prospect. Rowen was a light crop in all sections. Feed in pastures improved during the month to a marked degree. Mowings were green and luxuriant, even on light land, but with little growth of hay in most cases. Very much less than the usual amount of fall seeding was done, owing to the prolonged drought. Onions were hardly a normal crop, being smaller than usual. Potatoes were considerably under the normal in yield, and of small size but good quality. Root crops were generally backward, and not up to the normal. Celery also was a light crop, and late market-garden crops of all kinds were backward, but with prices generally higher than usual. Apples were reported as somewhat better than expected; pears the poorest crop for years; peaches nearly a total failure; grapes a fair crop, but late in maturing; cranberries late in maturing, and a light crop.

The final report of the season, at the end of October, showed that the crop of Indian corn was considerably below the normal in value, both for grain and stover, and this in spite of the unusually high prices which formed the basis of computation. A considerable portion of the crop was damaged by frost, and much more was cut before maturity to avoid that danger. Some reported that there were practically no ears. Corn raised for the silo also failed to mature properly. Root crops were considerably below the average, and generally brought good prices where raised for market. Turnips especially were reported as small and unsatisfactory in yield and quality. Potatoes did not rot as badly as indicated, but the crop was light, owing to poor germination and drought. They were reported as selling for good prices. Pastures improved during October. However, farm stock was reported, on the whole, as rather thin in flesh, especially in eastern sections, where the drought was most severe. Very much less than the usual amount of fall seeding was done. Most of that put in was sown later than usual, and was slow in starting. There appeared to be a good catch on most fields.

Prices for crops raised for market ranged a good deal higher than in former years, due in a large measure to shortages of most of the leading crops. Of the 128 correspondents answering the question as to prices, 5 spoke of them as average, 9 as good and 114 as higher than usual.

Concerning the questions as to which crops had proved profitable and which crops had proved unprofitable, 71 correspondents, more than a majority, considered hay to have been among the most profitable crops; 39, potatoes; 14, corn; 13, apples; 8, cranberries; and 7, onions; while 39 correspondents, about one-third of those replying, reported that corn was among the least profitable crops; 35, potatoes; 8, apples; and 6, cabbages. Other crops were spoken of by a few correspondents as belonging to the one class or the other.

The season of 1907 does not appear to have been a particularly profitable one for our farmers. Crops were not especially good, and, while prices received ruled high, grain and everything which the farmer had to buy was also above the normal in price. Of the 128 correspondents answering the question as to the profitableness of the season, 45 considered it to have been a profitable one; 21, that it was an average season; 6, that there had been a small profit; 18, that it had been fairly profitable; while 5 said that it had not been very profitable, and 33 that it had been an unprofitable season.

## Massachusetts Weather, 1907.

[Compiled from Data furnished by Weather Bureau, Boston.]

The weather of January was of mid-winter type, without especial features. There were the usual number of storms of average severity, with rain and snow, the monthly amounts being somewhat below the average. Some of the storms were accompanied by high winds and gales. The mean temperature, 29.4°, was 1° below normal. The weather was very cold during the last decade of the month.

The low temperatures continued through February, the month being one of the coldest Februarys on record, though the extremes did not depart greatly from previous years. The precipitation was nearly all snow, the total ranging from 11 to 36 inches. A severe storm on the 5th was accompanied by gales of from 60 to 70 miles per hour. The month as a whole was a very severe one.

The weather of March was more moderate than usual, with only two severe storms. The average temperature ranged from 1° to 4° above the average for March. The minimum temperatures of the first decade were low, and the maximum temperatures during the closing days were high for the season. At the close of the month the ground was free from snow.

April as a whole was very unseasonable, with weather conditions more like March than April. The monthly average temperature was from 1° to 4° below the April normal. There was much cloudiness and a heavy fall of snow, from 2 to 18 inches, on the 8th, 9th and 10th. The month closed with the season from ten days to a fortnight later than usual.

May opened with seasonable weather, but there was a marked drop in temperature, and it continued very cool until the 9th. From the 10th to the 20th the weather was seasonal. The remainder of the month was unusually cool, light to moderate frosts occurring on several nights. There was also a deficiency of sunshine for the month, although the monthly precipitation was generally deficient in amount. The month was one of the most unpleasant of its name.

Unseasonably cool weather continued until June 15. From that date to the close of the month the daily temperatures were generally above the normal. There was much cloudy, unsettled weather during the first two weeks. The last half of the month was quite dry, the rainfall being light and irregularly distributed. There was also much sunshine, and by the 25th there was general need of rain. Owing to uniformly cool weather during the first half of the month, there were very few thunderstorms, but during the rest of the month they occurred with average frequency.

The weather of July was seasonal, with abundant sunshine and uniformly high temperatures through the entire month. The monthly means were from 1 to 1½ above the July normal. The per cent of humidity was generally high, and the weather oppressive. The rainfall was very unevenly distributed, resulting from local storms, the showers as a rule occurring in the afternoon or night. The weather of the month was generally ideal for the mid-summer season.

The weather for August as a whole was marked by an absence of cloudiness, an unusual amount of sunshine and a great deficiency in rainfall. Except in a few localities the rainfall for the month was less than 1 inch, making it the driest August, with the exception of 1883, during the past thirty-six years. Although there were less than the usual number of days with a high maximum temperature, the average temperature of the month was somewhat above the normal.

From the 2d to the 5th of September a heavy rainfall throughout the State effectually relieved the drought that had prevailed during July and August. Occasional showers fell until the 11th, and from the 12th to the 20th fair and generally clear weather prevailed. From the 5th to the 24th, with the exception of three or four days, the temperature was much above the normal, and much like that usual in August. From the 25th to the close of the month the temperature was lower and somewhat below the normal, frost occurring in some localities on the night of the 25th.

The month of October as a whole was exceptionally pleasant, there being much fair, sunny weather, with many days of the Indian summer type, and moderate temperatures, generally near the seasonal average. Two well-defined storms of considerable intensity passed over the State. The first one was on the 8th, when general and heavy rains fell in all sections, and high winds to strong southerly and westerly gales prevailed along the coast. Much delay and some damage from the violent winds resulted to shipping. The second storm was on the 28th–29th. This disturbance also caused dangerous gales along the coast, although there was little damage to shipping. The rainfall during this storm was quite general, but the amounts were not excessive. Light rains fell on the 4th and on the 20th. A well-defined cool wave prevailed on the 21st–22d, during which killing frosts occurred in all except immediate coast sections, with light to moderate freezes in interior sections of the State.

In November the general weather conditions presented no marked departures from those usual to the season. The month as a whole was somewhat warmer than usual for November. The precipitation was generally in excess, and rather irregularly distributed. It was in the form of rain, except during the last week of the month, when snow varying from a trace to 6 inches fell over the State. The principal storms of the month occurred on the 3d, 6th, 7th and 25th. Those of the 6th and the 25th caused high winds and gales on the coast, and the latter gave nearly all the snowfall of the month.

December was warmer and more pleasant than the average December. The mean temperature, entire State, 33°, was 3° above the normal for the month. The daily temperatures were below the seasonal average during the first week and generally above during the rest of the month. The lowest temperatures were generally on the 5th and the highest on the 10th. The precipitation was above the normal in all sections, with the greater portion of it as rain. The monthly snowfall ranged from 5 to 17 inches, and it was greatest in the central and western portions of the State. It fell chiefly on the 14th and the 15th. There was somewhat more than the average amount of sunshine and clear weather.

## METEOROLOGICAL OBSERVATIONS AT THE MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION.

[Latitude, 42° 23′ 48.5″ N.; longitude, 72° 31′ 10″ W. Height of barometer above ground, 51 feet; above sea level, 273.5 feet. Height of wind instruments, 72 feet.]

### ANNUAL SUMMARY FOR 1907.

*Pressure (in Inches).*

Maximum reduced to freezing, 30.44, February 24, 1 A.M.
Minimum reduced to freezing, 28.68, April 9, 12 P.M.
Maximum reduced to freezing and sea level, 30.78, February 24, 1 A.M.
Minimum reduced to freezing and sea level, 28.99, April 9, 12 P.M.
Mean reduced to freezing and sea level, 30.018.
Annual range, 1.79.

*Air Temperature (in Degrees F.).*[1]

Highest, 96.0, August 12, 4.00 P.M.
Lowest, —23.5, January 24, 7 A.M.
Mean, 45.2.
Mean of means of max. and min., 45.4.
Mean sensible (wet bulb), 40.8.
Annual range, 119.5.
Highest mean daily, 78.6, July 18.
Lowest mean daily, —8.0, January 24.
Mean maximum, 55.8.
Mean minimum, 35.1.
Mean daily range, 20.7.
Greatest daily range, 43.0, May 14.
Least daily range, 2.0, June 2.

*Humidity.*

Mean dew point, 36.9.
Mean force of vapor, .355.
Mean relative humidity, 77.9.

*Wind.— Prevailing Direction, West.*
*Summary (Per Cent).*

North, northwest, 10.
West, 10.
South, southeast, 10.
Northwest, 11.
South, 9.
West, northwest, 9.
Other directions, 41.
Total movement, 60.016 miles.
Greatest daily movement, 529 miles, February 3.
Least daily movement, 18 miles, December 8.
Mean daily movement, 164 miles.
Mean hourly velocity, 6.8 miles.
Maximum pressure per square foot, 32.5 pounds = 81 miles per hour, July 20, 8 P.M., W.
Maximum velocity for 5 minutes, 44 miles per hour, March 24, 3 A.M., N.N.W.

*Precipitation (in Inches).*

Total precipitation, rain or melted snow, 42.27.
Number of days on which .01 or more rain or melted snow fell, 122.
Snow total in inches, 54.5.

*Weather.*

Mean cloudiness observed, 49 per cent.
Total cloudiness recorded by sun thermometer, 2,137 hours = 48 per cent.
Number of clear days, 95.
Number of fair days, 155.
Number of cloudy days, 115.

*Bright Sunshine.*

Number of hours recorded, 2,317 = 52 per cent.

*Dates of Frosts.*

Last, May 22.
First, September 27.

*Dates of Snow.*

Last, May 11.
First, November 24.
Total days of sleighing, 67.

*Gales of 50 or More Miles per Hour.*

January 9, 53 miles; W.N.W.
February 3, 63 miles; N.N.W.
March 29, 74 miles; W.N.W.
July 20, 81 miles; W.
December 10, 61 miles; S.S.E.; 31, 50 miles; N.W.

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[1] Temperature in ground shelter.

J. E. OSTRANDER, *Meteorologist.*
T. A. BARRY, *Observer.*

# MEETINGS OF THE EXECUTIVE COMMITTEE

OF THE

# BOARD OF AGRICULTURE

1907.

# MEETINGS OF THE EXECUTIVE COMMITTEE, ACTING FOR THE BOARD.

BOSTON, March 28, 1907.

The executive committee met at the office of the secretary this day, at 2 o'clock P.M., a majority of the members being present.

*Voted,* To assign each member of the Board representing an agricultural society five copies of Forbush's "Useful birds and their protection."

*Voted,* That 500 copies of said book be retained in the secretary's office, 200 of which shall be for the use of Mr. Forbush, and the remainder to be given out at the discretion of the secretary.

BOSTON, April 30, 1907.

The executive committee met at the office of the secretary this day, at 2 o'clock P.M., a majority of the members being present.

The matter of the request of the Middlesex North Agricultural Society for permission to sell its real estate was presented by President Cluer. No one appearing in opposition to the request, and it appearing that the law had been fully complied with, it was —

*Voted,* To grant the request of the Middlesex North Agricultural Society, in accordance with the provisions of Revised Laws, chapter 124, as amended by Acts of 1907, chapter 189.

A communication from Mr. George Albree of Concord, in relation to the milk standard, was presented, read and by vote placed on file.

A paper on "Early agricultural education in Massachusetts," prepared by First Clerk Fowler, was presented, and by vote was accepted for publication in the annual report of the Board.

Boston, July 19, 1907.

The executive committee met at the office of the secretary this day, at 11 o'clock A.M., a majority of the members being present.

A petition of the Bristol County Fair, Incorporated, for dates of September 17, 18, 19 and 20 for its 1907 fair, was presented and considered. Representatives of said society and of the Weymouth Agricultural and Industrial Society appeared. It being found that two days of the latter's fair would be interfered with if the petition was granted, it was —

*Voted,* To give the petitioners leave to withdraw.

Mr. C. E. Ward was assigned as inspector to the Hoosac Valley Agricultural Society, and was also appointed to the committee on institutes and public meetings, to fill vacancies caused by the resignation of Mr. Sessions from the Board.

Mr. T. L. Tirrell was assigned as inspector to the Worcester County West Agricultural Society, and was also appointed to the committee on agricultural societies, to fill vacancies caused by the death of Mr. Reed.

# SPECIAL BUSINESS MEETINGS

OF THE

# BOARD OF AGRICULTURE

1907.

# SPECIAL BUSINESS MEETINGS OF THE BOARD.

GREAT BARRINGTON, June 25, 1907.

A special business meeting of the Board, in connection with the summer field meeting, was held at the Berkshire Inn, Great Barrington, this day, at 8.30 o'clock, A.M., Second Vice-President Pratt presiding.

Present: Messrs. Adams, Boardman, Bradway, Danforth, J. L. Ellsworth, Gerrett, Mason, Millard, Paige, Pease, Pratt, Richardson, Spooner and Worth.

The credential of Mr. Wm. N. Howard of South Easton, delegate-elect from the Bristol County Fair, Incorporated, and that of Mr. Theron L. Tirrell of South Weymouth, elected to fill the unexpired term caused by the death of Mr. Reed, were presented and were accepted by vote of the Board.

The matter of fixing the dates for the holding of the 1907 fair of the Bristol County Fair, Incorporated, was referred to the chairman of the executive committee and the secretary of the Board to consider, and, if deemed advisable, to call a meeting of the executive committee.

WORCESTER, Aug. 13, 1907.

A special business meeting of the Board was held at the Fair Grounds, Worcester, this day, at 2 o'clock P.M., in connection with the summer field meeting, Second Vice-President Pratt presiding.

Present: Messrs. Adams, Appleton, Bailey, Bradway, Danforth, Albert Ellsworth, J. Lewis Ellsworth, Gerrett, Jewett, Kilbourn, Mason, Millard, Pease, Peters, Porter, Pratt, Rane, Ross, Sagendorph, Stevens, Tirrell and Ward.

The request of the Essex Agricultural Society for approval of its vote to mortgage the property of the society to the amount of $6,000 was presented by Mr. Danforth. No one appearing in opposition, and it appearing that the law had been complied with, it was —

*Voted,* To approve the request of the Essex Agricultural Society, in accordance with the provisions of Revised Laws, chapter 124, as amended by Acts of 1907, chapter 189.

Dr. Peters, Chief of the Cattle Bureau, presented through Secretary Ellsworth his eleventh semiannual report, which was accepted.

Mr. Danforth presented the following preamble and resolutions, which were unanimously adopted: —

*Whereas,* Congress has directed the Secretary of Agriculture to investigate the work of the Bureau of Biological Survey of the United States Department of Agriculture, and report to what extent it "is of practical value to the agricultural interests of the country," now, therefore be it

*Resolved,* That the Massachusetts State Board of Agriculture regards the work of the Biological Survey as of great value to the agricultural interests of this country, and requests the Senators and Representatives from Massachusetts to make every effort to secure larger appropriations for the work of this Bureau, that its investigations may not be hampered by a lack of means for necessary work.

In support of this resolution we present the following statement of facts: —

(1) The work of the Biological Survey is carried out as outlined by acts of Congress, and includes investigations relating to the geographic distribution of animals and plants, the economic relations of mammals and birds to agriculture and the preservation of birds and game. The Biological Survey is also given by law certain police powers regarding the preservation of birds and game, and the supervision of the importation of foreign mammals and birds.

(2) The mapping of the life zones of the country and their correlation with the crop zones — a work which is intrusted to this Bureau — is of the greatest value to practical farmers, who will be saved many costly experiments by having ready a guide to the crops most likely to succeed in a given locality.

(3) The great mass of facts collected by the Biological Survey is accurate, varied and most valuable. Its publications should be made more accessible and given a far wider distribution than now obtains, and means should be provided for publishing the mass of unpub-

lished material which the agents of the Survey are continually accumulating.

(4) The important work of mapping the life and crop zones, that of investigating the economic relations of birds and mammals, the means of protecting the farmer against imported pests and of protecting crops against their enemies — all merit generous and adequate support on the part of the Representatives of Massachusetts in Congress. No less important is the work of bird and game protection, which is especially needed in the State. And be it further

*Resolved,* That the secretary of this Board be requested to forward a copy of these resolutions to the Secretary of Agriculture, Washington, D. C., and a copy to each of the Senators and Representatives of Massachusetts in Congress.

# SUMMER FIELD MEETINGS

OF THE

# BOARD OF AGRICULTURE

1907.

# SUMMER FIELD MEETING OF THE BOARD, AT GREAT BARRINGTON.

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A summer field or demonstration meeting of the Board was held at the grounds of the Housatonic Agricultural Society, at Great Barrington, Tuesday, June 25, 1907, the following programme being carried out: —

At 9.30 o'clock A.M. Mr. P. M. Harwood of the Massachusetts Dairy Bureau demonstrated the points of a dairy cow, illustrated by animals of the dairy and beef types.

At 10.15 Dr. Geo. M. Twitchell of Auburn, Me., demonstrated the best types of horses for breeding in Massachusetts, illustrated by animals of the various types.

At 11 Hon. W. H. Blodget of Worcester demonstrated the packing of apples for market, being assisted by Mr. W. P. Thayer.

Dinner was served in the dining hall of the society at 12.30 P.M. at a cost of 50 cents per plate.

At 1.45 P.M. Mr. W. D. Rudd of Natick demonstrated the killing and preparation of fowls for market.

The day was very warm. The attendance was estimated at from 250 to 300.

## SUMMER FIELD MEETING OF THE BOARD, AT WORCESTER.

A summer field or demonstration meeting of the Board was held at the grounds of the Worcester Agricultural Society, at Worcester, Tuesday, Aug. 13, 1907, with the following programme: —

At 10.15 o'clock A.M. Professor Rane, State Forester, demonstrated how to grow a forest from seed, illustrated with seeds and seedlings.

At 11 Prof. S. T. Maynard of Northborough demonstrated proper methods of budding and grafting fruit trees, showing proper tools and appliances, with instruction as to pruning.

At 11.45 Mr. Henry M. Howard of West Newton demonstrated the proper methods of planting, setting and caring for market-garden crops, particularly lettuce, celery and cauliflower.

At 12.30 P.M. a clam bake was served on the grounds, at $1 per plate, and facilities were also afforded for obtaining coffee, sandwiches, etc. It is estimated that about 150 partook of the clam bake.

At 2 P.M. Dr. James B. Paige of Amherst demonstrated the soundness of the horse, with instructions as to feed and care, when in use and when idle.

The day was unusually warm. The attendance was estimated at about 250.

# PUBLIC WINTER MEETING

OF THE

# BOARD OF AGRICULTURE,

AT

# BOSTON.

DECEMBER 3, 4 AND 5, 1907.

# PUBLIC WINTER MEETING OF THE BOARD, AT BOSTON.

The annual public winter meeting of the State Board of Agriculture was held at Horticultural Hall, Boston, on Tuesday, Wednesday and Thursday, December 3, 4 and 5. The attendance was fairly large, and the meeting was considered an exceptionally good one.

The gathering was called to order at 10 A.M. by Secretary Ellsworth, who introduced Gen. Stephen M. Weld, president of the Massachusetts Horticultural Society, who delivered the address of welcome.

## ADDRESS OF WELCOME, BY GENERAL STEPHEN M. WELD.

On behalf of the Massachusetts Horticultural Society, I give you, members of the State Board of Agriculture, a cordial greeting to-day, and rejoice with you in our common prosperity.

In the past the histories of the two organizations show that many of the brightest and ablest agriculturists were members of both, such as General Dearborn, Governor Boutwell, Marshall P. Wilder, and others too numerous to mention. They all worked for the common good of both agriculture and horticulture.

Although varied industries are necessary to the full development of the resources of a country, agriculture is the foundation of a rich and prosperous community. We in Massachusetts, as well as in the rest of New England, were compelled by the poverty of our soil to develop in every way, such as the sea, in our fisheries and shipping; manufactures of all kinds, — cotton, wool and leather; and the very fact of our poor soil made us struggle the harder, and turn out a race of hardy, strong and vigorous men, who have made the country what it is.

England has devoted herself of late years almost entirely to manufactories, and is compelled to call upon the rest of the world for her food supplies, and she will at some time suffer for it severely. The drop in the price of lands, the lessened interest in agriculture, as shown for the past sixty years in England, must necessarily injure the country and stop its proper development.

After all, the basis of all prosperity in a nation rests on her farmers. We cannot run our cotton mills without cotton, our woolen mills without wool from the sheep, and our boot and shoe factories without hides from the cattle. We all of us, too, when worn out by mental work necessary in professional and mercantile pursuits, must fall back on contact with the soil, like Hercules of old in his contest with the giant Atlas. The folk lore of nations and the mythology of the ancients are but the crystallization and condensing of the experience of ages. They are put in the form of legends and stories, and so are more easily understood and comprehended by the mass of the people. Of such is the story of the giant Atlas, whose overcoming was one of the tasks set Hercules. Atlas upheld the world on his shoulders. Hercules could do nothing so long as Atlas was in touch with the soil. Every time he was felled to the earth, he jumped up with redoubled strength. Hercules could not conquer him until he held him in the air, out of contact with the mother earth. So it is with ourselves. Each time we come in touch with the soil we gather renewed strength and health.

We feel that our society is one of if not the strongest and best in the United States, and that it is more alive and more earnest in its endeavors to promote the welfare of the community than any other organization of the same kind.

This also, we feel, applies to the Massachusetts Board of Agriculture. We must work hand in hand and side by side for the general success of the ends towards which we are struggling. Let me assure you that you have the hearty good-will and best wishes of every member of this society in the success and development of your organization. Where one does well the other must also.

Secretary Ellsworth. The Governor, who is a member of the Board of Agriculture, and its president, generally honors us with his presence during some of the important sessions, but seldom have we been thus honored at the first session. It is my pleasure to introduce to you His Excellency Curtis Guild, Jr.

## ADDRESS BY HIS EXCELLENCY CURTIS GUILD, JR.

Mr. Secretary, General Weld, ladies and gentlemen: I am extremely sorry that in the last report of the State Board of Agriculture the secretary should have noted that I cancelled my engagement last year in Springfield, but omitted to state that the only thing that could have kept me away was the supposed fatal illness of my wife, and a man's first duty lies at home and not to his public office.

It is a double pleasure for me to be here to-day and welcome you to the city of Boston, and thank the Horticultural Society, through its president, whose interesting address of welcome we have all heard with so much pleasure, for the kindness and courtesy which they have thus extended. I want to emphasize what General Weld has so truly said, — the importance in any community and any nation of that class of the population who come not in indirect but in direct contact with the soil, and the fact that all the industries of the nation must in the last resort rest upon the prosperity of the farmer and the cultivator. I am fond of quoting the good old English song, "God speed the plow," with which I suppose you are all familiar. If that was a good song in the good old days of Queen Elizabeth in England, it is a good song here in Massachusetts to-day. I want you to understand that, not the heads of the State Board of Agriculture, but the Massachusetts State Board of Agriculture doesn't listen in silence to any flings or stings or reflections on Massachusetts as an agricultural State, and her standing as such among all the States of the Union. I sometimes think it unfortunate that the critical character of the

Massachusetts mind, eager for self-improvement, eager for the building up of a community, should in such large numbers throughout the Commonwealth be loath to praise and eager only to criticize and to censure. For example: last year in 1906 we passed a sliding scale law for the regulation of the great gas company here in Boston, — a law, which, as you know, provides that where increased earnings are made for certain public-service corporations, they shall be shared by the people; that is to say, that when the company increases its earnings, it must reduce the price of gas to the public before it can increase the dividends to its stockholders. That is an automatic regulation for corporations which was initiated, in the United States, here in Massachusetts. You have never seen very much about it as a grand piece of pioneer legislation in the papers of this Commonwealth, but the Massachusetts law is honored outside of Massachusetts, and this law is the first great step in that kind of progress taken in the United States of America. This last year we have seen the Governor of New York take up the general regulation of corporations through so-called public utility commissions, — very excellent and very admirable institutions, — and curiously enough it suggested that Massachusetts should copy that excellent institution! Why, gentlemen, we have been regulating corporations for twenty-five years. We don't need to copy New York; New York has copied us, and in a less effective manner than the corporations are now being regulated right in our own State.

I sometimes think in a similar fashion the public ought to have been told what the farmers are doing in our State, as the secretary has shown, and does every year, in his admirable report of the work of the State Board. We listen too much in silence to these reports of abandoned farms in New England. Why, even Cape Cod is increasing in population, — all built up on blueberries and cranberries! It is worth while to remember there is still a chance here, a splendid chance, if we only choose to go about it in the right way. The old-fashioned kind of cultivation is going out. It is impossible to make money by raising hard corn and pumpkins; it doesn't pay. But if the farmer uses the same brains and progressive methods as other business men do, — the farmer must be a business man, — he can make a living, — a handsome living. And it is an interesting fact that the new citizens coming to Massachusetts are not now staying, as they used to stay, in the cities, but are going out to the farms of the State, out to the soil. Twenty years ago I suppose there was not an Italian farmer in the Commonwealth of Massachusetts; now you find wagons coming in every morning with Italian names, truck farmers, in the vicinity of Boston. A Polish farmer until recently was absolutely unknown; but those of you who come from that district know there are many of them now in the Connecticut valley. And it seems to me it is an encouraging sign.

A few days ago it happened to be my duty to preside over a national convention in the city of Columbus, O., with representatives from all the different States in the Union and most of the Provinces of Canada. The subject was the general one of taxation, and we considered the needs of the agricultural population; and I think you will find this coming year that in some of the States there will be an attempt made for a better equalization of the burden of taxation; that certain class taxes that are now paid by farmers as real estate and are not paid by most of the inhabitants of the great cities may be lifted from the farmer; that the burden of taxation may press more evenly upon the whole people of the United States, and not upon one particular class. That was the first convention of the kind ever held, — the first convention of the kind where the men, not of one nation, but of two, came together in the cause of justice and equity, and adopted resolutions that whereas equity and justice demanded that the same property should not be taxed twice, once in one State and once in another, the same interest of equity and justice demanded that two nations should treat each other as two States use each other, — that neither should be allowed to be used as a refuge for tax-dodgers; and it was equally just and right that property taxed in one country should not be levied with another tax in the other country.

At that meeting there was one of the old, familiar objectors to New England, a professor of the college which boasted of having the largest attendance of any in the United States, — we won't talk of tainted money or economy, — I mean the University of Chicago; and he rose up, and in describing the universal decline of land values in the United States said that the soil, as he expressed it, was "skinned," and consequently farm products no longer figured in the wealth of the New England States. He described with glowing words the magnificent opportunities of the west, and the fact that farming was a failure in New England. It became necessary for a certain State official, whose name I withhold, to leave the chair and take the floor, and to explain to him that we would be very glad in Massachusetts to learn of any great industry in Illinois which annually produced $64,000,000, the value of the farm products in Massachusetts alone. I think it is higher than that; $64,000,000 in 1905. It was interesting to tell the gentleman in question that that has shown a steady increase from year to year. It was interesting to remind him that the abandoned farm department of the Commonwealth of Massachusetts had itself been abandoned. It was interesting to quote to him the increased market gardening; the opportunities of raising small fruit; the fact that a box of Massachusetts cucumbers, raised by Brother Rawson here, was worth the yield of a whole acre of Illinois wheat or corn; that the finest roses of a certain kind, the "Bridesmaid" rose, — I think they are called that as they were primarily raised at Wellesley, where the bridesmaids come from, and the brides themselves too, oftentimes, — are raised here and all through Massachusetts. All farm products, and especially the dairy products and the poultry products, are raised all over the Commonwealth.

He came to me afterwards and said the economist didn't regard those as agricultural products; and I asked him if he regarded the tomato a product of the fisheries, or the cucumber a product of the mines, — a mineral. I think agriculture in the public eye is too apt to be confined simply to the growing of crops and cereals. We don't recognize as we should our own place among the States in this great and growing industry.

I like very much to quote a story — perhaps I have told it to some of you already — of how a fencing master, who came over here to the United States, as many a worthy fellow has done before, to seek a living, to get a better living than he could in the old country, succeeded. He taught me fencing about twelve years ago, when I used to take foils with him at the gymnasium. One day he came to me with this pamphlet of farms which were for sale for the sake of the taxes. He had noticed an old farm down in Plymouth County, where a Yankee farmer had died, and then the family gradually had died out, and this was simply a piece of not very fertile soil, not deep, rich soil; there was an old apple orchard on it, and a sort of a swamp in one corner, where a brook habitually overflowed and left a muddy pool. This Frenchman went down there with his wife. The first thing they did was to drain and dam that pool and brook, — it had previously been dammed in another way, but it never had been drained, — and they got a place where they could raise ducks. They proceeded to raise ducks for the market. In the brook above the pool they started watercress. He purchased a few old windows, and began growing early vegetables under glass. His orchard was all run out, the apples were no longer of any particular good for eating or cooking, but they were still good enough to make cider, and he proceeded to utilize them for that purpose. Having started with his ducks, he then proceeded to go to work on fancy poultry, where a single egg you all know will often bring a larger amount than an entire fowl of the old-fashioned brand. Gradually he accumulated more and more money, until he was able to bring his father and mother over from France, — those French peasants, people who sometimes crumble the soil with their fingers to get perfect access of moisture and air. Those people, accustomed to hard work and intensive farming, went to work on that old, abandoned land. The man had to put a mortgage on the farm when he bought it, as he had very little money. Father, mother, brother, sister, children, husband and wife are all supported on that single patch to-day, where twenty years ago it was loudly announced on the political stump that it was no longer possible for any man to make a living. And they are not only supported, but, with the aid of small fruits and the other crops which they are able to grow even on that thin soil, they are supported in comfort. A man whose father and mother were in danger of becoming in their native country mere wards of the town, going into what corresponds to our poorhouse, is now living in perfect comfort, supports himself, is a naturalized American citizen, and votes, — well, I won't tell you what ticket he votes, — and drives his own team, and has built up there on what was a mere waste patch of mud and rocks a prosperous home, — a self-respecting, comfortable family.

There is opportunity for agriculture in Massachusetts; and it is a matter of pride that, although our own State doesn't know what the farmer is doing, doesn't appreciate what the progressive market gardeners have invented in Massachusetts, first of all the States, for the use of flower beds, doesn't appreciate that we lead every Union State in the value of our agricultural products, doesn't appreciate the fact that Massachusetts exhibits, wherever they may be, in St. Louis, Atlanta, Nashville, wherever we do exhibit them, — Massachusetts, not Dakota, not Illinois, not Indiana, takes the gold medal for quality, if not for quantity.

I now take great pleasure in presenting to you the first speaker of the day, Prof. H. F. Hall, professor of horticulture, New Hampshire College of Agriculture and the Mechanic Arts, Durham, N. H.

# MARKET GARDENING.

BY PROF. H. F. HALL, DURHAM, N. H.

Market or commercial gardening represents the most intensive branch of agriculture. Within a few miles of Boston gardening is carried on upon land worth from $1,000 to $3,000 an acre, in many cases $200 to $400 per acre being spent for fertilizers, seeds, labor, etc., before the crop is ready for market. Realizing these things, we must admit that it is certainly very intensive work, and requires skillful management. Gardening in New England has assumed enormous proportions within the past fifteen years, and is a good business if rightly managed. It is attended, however, with risks, as in the case of other pursuits. No set of hard-and-fast rules can be laid down, the following of which will always bring the desired results; but careful and intelligent effort will finally win. Classes or even varieties of vegetables profitable in the hands of one grower or on one kind of soil may be unprofitable when grown by another, or by the same person on other parts of his garden. It therefore becomes necessary for each individual to work out many problems which cannot be otherwise determined. Careful bookkeeping will determine the profit and loss from certain crops and methods, and will prevent the drawing of many false conclusions which will be misleading and often very expensive.

In these days of keen competition, a gardener needs both scientific and practical knowledge to achieve the greatest success. He must be intelligent, practical and ambitious, giving due importance to location, soil, moisture, seed, fertility, cultivation, insects, diseases, packing and marketing, if he would make the greatest success of his undertaking.

The tendency of the times is toward specialization, as vegetables can be produced at a less cost per acre when grown in large quantities. Such a grower is recognized in the market, and his truck sought by the dealers. Furthermore, when grown in this way the crop reaches its highest state of perfection, due to a more thorough knowledge of its needs and careful attention to its culture than is possible where a number of crops, each requiring special care, are grown. Vegetables of good quality, well packed and delivered regularly in large quantities, sell readily at good prices on any market; while poor truck, improperly packed and in small quantities, usually goes begging for a buyer at a low price that pays no profit to the grower.

Near our large cities, where stable manure is abundant and cheap, our gardeners depend upon it almost entirely for fertilizing their land. It contains a large amount of organic matter, which improves the physical condition of the soil, adds plant food and conserves moisture. Where manure is more expensive and difficult to obtain, a light application supplemented with chemicals will in many cases produce a crop of equal size, and, with some vegetables, superior quality to that fed entirely upon stable manure. Nitrate of soda produces a rank and rapid growth of foliage thus increasing the yield and improving the quality of crops grown for their foliage. Phosphoric acid has a beneficial influence upon fruit-bearing crops, such as sweet corn, tomatoes, beans, squash, etc. Potash improves the quality of most vegetables, especially such crops as potatoes, squash, carrots and parsnips.

Starvation is a common cause of crop failure. A profitable crop cannot be obtained without a normal, healthy growth of the plant. Thrifty plants are less subject to the attacks of diseases. If I were to give a general preventive of plant diseases, it would be plenty of plant food and thorough tillage, as strong, healthy plants will usually withstand and outgrow such attacks, while others growing under less favorable conditions are destroyed or seriously injured.

Every gardener should follow a well-thought-out plan, giving proper rotations, and with planting dates so arranged as to avoid gluts and allow double-cropping when possible.

Good seeds are indispensable in gardening. The more intensive the culture, the greater their importance. When sure of obtaining a desirable strain, the gardener should purchase in large quantities, as such seeds are not always available; and, furthermore, experimenting in a large way with seeds of unknown value is expensive, and should be avoided as much as possible.

When a grower discovers a good strain of seed, he should buy heavily, and be sure of enough not only for one season, but several. In doing so he is sure of the best seeds, which are of great importance to any grower, especially where his land is high priced and his cultivation intensive.

When the crop is ready for market, the packing and selling is an important part of the market gardener's work. Vegetables of good quality, well grown and properly packed, strengthen the market and increase the demand. A great many times we have in our larger markets like Boston a serious glut. Everything in certain lines is selling very slowly, but there is generally very little difficulty in selling the best truck if it is well packed. Appearance and quality in almost all markets are at a premium, the larger markets paying more for quality than the smaller ones. In the smaller markets we find often one universal price offered for a certain vegetable, regardless to a certain extent of its value. In the larger markets this is seldom true; here quality usually counts, and commands a good price.

When selling No. 1's be sure the box contains only No. 1's. A great many, though not following this rule, believe in it, and consider it a proper thing for the other fellow to do; and so we go on packing our vegetables with the better specimens on top. I believe, if every grower packed his truck honestly, — and by honestly I mean the same right down through the box, — that it would be better for every one concerned, and in a few years there would be greater confidence on the part of dealers and consumers.

The complaint of over-production is often a misapprehension of the condition, the real cause being under-consumption, due to inferior quality and poor packing, or an uneven supply or both. We must learn that it pays to give nice delivery to the buyer. The California growers of fruits and vegetables have taught us a valuable lesson in this respect. With no advantage in quality, they are shipping their crops long distances to the east, and competing with us successfully in our home markets. This is because we are at least a decade behind the California growers in handling our products after they are grown. A great many people further back from the large cities are continually inquiring about the methods of selling their crops. It is a problem with them whether to grow in a large way and send to the larger cities, such as Boston and New York, or grow in a smaller way and sell in the home market. Usually the local market, if of sufficient size, is preferable. If not, it becomes necessary to ship to the larger cities, where the selling must be done through commission men. I believe in selling direct, if possible. A great many are selling on commission, and it is necessary in a great many cases to do so; but where not, sell outright. The dealer takes your goods on commission, and, as he also buys outright other goods of the same nature, he will naturally give the preference to his own.

I don't say they all do this; I say it is natural that they should do so, and it is all we can expect of such a dealer. I have frequently heard a commission dealer say to a customer, "I can give you a good trade on that lot, as it was sent in on commission." A large part of our garden products are perishable goods; therefore the greater necessity for a general knowledge of supply and demand, learned only through organization. We must look out for our own interests; we must fight our own battles. The New England gardeners are past masters in the growing of their crops, but are behind the times in the matter of selling. This condition is doubtless due to the lack of organization. The manufacturer and dealer establish their own prices, the banker fixes the rate of exchange, while the gardener seldom knows the price of his goods until he arrives in the market and is informed by his customer.

Organization is the watchword of the hour. We should work together, buy and sell together, and in general act together, for our mutual advancement and protection as occasion may require. If each gardener acts for and by himself, we cannot hope to advance. By organization we can settle transportation and marketing difficulties, advertise our goods as other business men are doing; it will elevate the profession of gardening and place it on a level with other progressive industries, and cause us to have a higher regard for ourselves and our chosen work.

The manufacturers of various kinds of goods, when they come face to face with the labor problem, such as the gardener is facing at the present time, have a way of overcoming it, and it is through organization. If labor is increased 10 per cent, the prices of their goods are increased to the same extent, so their is practically no loss to them through the raise of prices. The gardener, however, is unable to offset the advance in labor, as he is at the mercy of the markets by not being organized and able to fix to any extent the price of his products.

There is one stumbling block, it seems to me, in the way of co-operation, and that is, a feeling on the part of the larger growers that by organization they are lifting the weaker growers or brothers up to their level and making of them rivals, while they are narrow-minded in overlooking their real competitor, — the southern grower. Through organization we may not succeed at once in accomplishing all we desire, but step by step we should attempt its accomplishment.

Governor GUILD. There are other interests that claim my attention, and I shall have to leave you, but I want to congratulate you most heartily on the auspicious opening of this session, and especially on the highly interesting paper to which we have all listened with such great pleasure.

I notice with a great deal of interest that one of the other papers is to be on insect enemies to fruit trees; and, if you will excuse a rank outsider, who really uses agriculture merely as a student, and not from any practical point of view, I trust this session will bring out something in regard to our historic friend since the ancient world, — the apple. Whatever theological faith we have, there isn't much doubt but the original human race, or the gander part of it, enjoyed that fruit. It then came into Greece and Rome, and was brought across the ocean by merchants, and thus scattered by the John Appleseed, and finally crossed the continent to Utah, and the apples of Utah exported to China and Japan; and the white man crossing the waters of Asia has completed the circle of the earth, and carried the apple with him. Now, New England has no competition with the south, as you speak, in the orchard. It does have competition with the west. I have spoken of some of the pleasant things about Massachusetts, but it is not to the credit of this Commonwealth that, in a climate suited to the growth of orchards and a soil where apples can well be raised, we should be having competition with fruit of that description raised on the Rocky Mountain plains and under natural disadvantages. The Mormon elder is not supposed to be the superior in intelligence of the Massachusetts farmer. The Mormon elder has nothing but a barren plain, to which he himself by human labor has to convey the necessary moisture for the raising of his crop. Massachusetts has no excuse for the utter destruction of her orchards; and I trust that the day is not far distant when Utah apples will cease to be imported into Massachusetts, and when Massachusetts apples will be, not a temptation to man's downfall, but an aid to man's prosperity.

I now take great pleasure in presenting to you as chairman during the discussion, Mr. William H. Spooner of Jamaica Plain.

The Chair. It was a happy thought of our secretary to choose as one of the subjects for discussion at this winter meeting that of market gardening. I believe to-day it is the most important branch of agriculture in Massachusetts. The fact that here near the great market we have, in the surrounding towns of Arlington, Belmont, Watertown, Newton, immense establishments, shows that the proprietors evidently had faith that there was room on top, and we have to-day some of the largest and best-conducted establishments in this country. I notice one of our market gardeners with us to-day, and I will call upon the Hon. Warren W. Rawson of Arlington to speak to you.

Mr. RAWSON. I thoroughly agree with nearly everything the speaker has said. You know it is very difficult to get up a lecture of this kind, and not say something. Fifteen years ago, as he mentions, we did not have the technical training that we have to-day, but we had less of it thirty or forty years ago; and we have found that the technical training which we have received, or which the young men have received, from the Agricultural College has been of great advantage to us all.

The farmers of Massachusetts, however, are not close enough in touch with the Agricultural College or with its departments. I believe we should have a course there for the market gardener or the man upon the farm, to run from the 1st of November to the 1st of May, because that is the time of the year when work upon the farm is not so pressing, and might well be spent in getting the technical part, and the other six months should be devoted to practical work on the farm. In this course there should be commercial instruction, that would teach the young man how to keep accounts, because that is one of the most important points in agriculture, — not only in market gardening but in any sort of farming.

One of the problems we have to contend with to-day in market gardening is that of help. It is a very difficult one to settle. I don't know that it is any more difficult for a market gardener than it is for the farmer; but for a market gardener it is much easier to-day than it was ten, fifteen or twenty years ago, because we have found that it is absolutely necessary to grow a large quantity of our crops under glass. To do this it is necessary to keep help the year round; and in keeping them that way we can get good help, — that is, by paying them good wages. A man who is willing to work is worth good wages; I don't care what department you put him into, he is worth good pay, and some men are worth twice as much as others. There is no regular scale for men.

I always contended that a man was worth what he can produce, and he is not worth any more, I don't care whether it is on a farm or anywhere else. Many of them get more. It is pretty easy for market gardeners near the larger cities to obtain help at the present time, there are so many immigrants coming over. We can get help that a few years ago we did not use, but which we are finding out now are often worth more than the men, — I mean the Italian women. There are hundreds — perhaps thousands — that go outside the city to work for market gardeners at the present time, where fifteen years ago I doubt if there was hardly one. They have learned to work upon the farm in their country, and they are worth much more than the Italian men, when you want any quick, handy work done.

The lecturer spoke of manure. I never say anything against fertilizers, because if it hadn't been for fertilizers I don't know what we would pay for manure. I always think that all they amount to is in carrying out the second or third crop. You will find it so in the south; where a few years ago they raised fine crops on good land, to-day they can grow but a very poor one. That is because they use fertilizers, and cannot get anything else. I have no fear of the competition of the south with market gardeners of New England, — not at all. We are gaining on them right along, and by and by you will find we can produce crops in Massachusetts as cheaply as they can produce them and send them up here, running their chances of selling them for something or nothing.

The lecturer also spoke of diseases of crops. That is a subject which has interested greenhouse men for a great many years, and we have found there is only one way that we can get rid of most of the diseases or germs in our soil, which has been used for a long time, and that is by sterilization. This is one of the greatest things, I think, for the benefit of the market gardener and greenhouse man, that has ever been introduced in the business. If you sterilize thoroughly, and heat the soil to a temperature of 212°, and heat it all, you can grow the finest crops on it that you or I ever saw. Do it thoroughly, and for the time being all the diseases and all the insects, all the weeds, will be vanquished.

The cost of crops is something that is very difficult to ascertain in market gardening; but, if you will keep account year after year of the different crops and the different prices they bring, you will find out in time that some crops are bringing enough to pay the cost of growing, while other crops are not; and to your surprise sometimes you will find that the crop that you thought was paying you best is one of the poorest-paying crops. I have gone at it this way, — when a crop didn't pay for three years, I got somebody else to grow that crop.

The question of seeds is a very important one to the market gardener. The price that he pays for seeds is nothing compared to the value of the work they are doing; that is, it is a very small amount of the expense of the crop, and for that reason a man who pays the biggest price for seeds is sure to get the best. A great many of the seeds sold to the market gardeners you don't find in the catalogue, neither the price nor the seeds, but the dealer has them for those customers of his who he knows want the best. And why does he keep them? Because he knows they will pay for them.

Thorough cultivation is one of the principal things in market gardening; once plowing and harrowing is very well, twice plowing and harrowing is a good deal better, and a third cultivation with fifty or sixty cords of manure to the acre is best of all. It is well to sell your goods in the market in large quantities, raising enough so you can be in the market every day, that they may know you are coming and know what you have; and also to put up your goods so they won't have to look at the bottom of the box to see what is in it, and to put them up so they can put a cover on them and send them anywhere and never have them come back.

Mr. Augustus Pratt (of North Middleborough). Many of the farmers in my section are obliged to use commercial fertilizers to a great extent, because we are located so far from the cities that we cannot get the dressing from the stables. Is it a fact that we are going to reduce our farms in consequence of this?

Mr. Rawson. We are situated very differently in New England. We can sow grass and other seeds and turn the green matter under, and make almost a good fertilizer in one year. In the south they can't grow grass at all; they can't find any grass.

Mr. H. M. Howard (of West Newton). I came in here looking for information, and that is what most of you are here for, no doubt. The lecturer is a near neighbor of mine. We are in the same business, I suppose; but he is interested in three large greenhouses and a market-garden farm right in Newton. The business he is running is very similar to my own, except that he is catering to the wholesale market, whereas I am working entirely, or almost entirely, for the retail market.

For three years I kept accurate time accounts of the labor put into the production of each one of the crops which I produce upon the farm, and at the end of the year we footed the columns and took the ratio of profit. I found some crops were paying me a return for the labor expended on them, $6 to $1 put into the labor, and other crops were an expense to me. I consequently dropped those crops.

I think it is a big mistake to try to get too cheap help, for the market gardener especially, who wants to get help that will produce the most for him, regardless of what it costs him. If he can get a man that is worth $2.50 a day right straight along, let him get him. He doesn't want to be fooling with a man that is worth only $7.50 a week, when he can pick up one that is worth twice that in a week, and he shouldn't. There are plenty of the cheap kind. I think that the rule of our market gardeners in getting their help is to hire everything that comes along, until we get as many or more than we want, and then pick out the best from the lot and give them a little more than the average going price, and try and hang on to them. If a man is making money for me on my place, I am going to keep him if I possibly can. If he does something I don't just like, I am going to get out of the way until I get over it, because I know he is going to make money for me, and that is what he is there for, and we can't always feel agreeable, — I don't, all the time; and when the boss is feeling disagreeable and the men are doing pretty well, he better keep out of sight, take a trip out to visit his neighbors, visit his neighbors in the same line of business once a week, and see if they are not in the same trouble he is with insects and diseases. And he should co-operate with them in getting our experiment stations to do the work for us.

Now, for years I have tried to produce spinach, and have been quite successful in producing a very good article, — a late fall spinach, having very little trouble with the yellow bee; but one year I had considerable trouble, and I spoke to our experiment station about it, and, as the lecturer says, they take very little notice of one man's question, but if we would organize a little more thoroughly and co-operate with each other, we could get the experiment stations to give more time to this trouble. One trouble in lettuce growing is what I call the white feather. The lettuce plants in the open field will be growing all right until about three weeks old, and then one leaf will start right up like a white feather, and the center of that plant will never head, while a very nice plant without that trouble may develop to a head which will weigh a pound or a pound and a quarter.

The lecturer says that good culture and good seed and plenty of plant food ought to cure any trouble in the growth of the plant, so that it would not be subject to disease; but we certainly have prepared our soil thoroughly, as Mr. Rawson has said, thoroughly plowed it, harrowed it and mixed the manure with it, so that every foot ought to be exactly the same as far as plant food goes and as far as the culture goes, and yet one head of lettuce ten inches from another is very different.

The CHAIR. We would be very glad to hear from Mr. Cook of Shrewsbury.

Mr. COOK. I think keeping accounts one of the essential points in market gardening, — to know what our crops cost us, especially those grown under glass.

Concerning the use of fertilizers, of course a good many back from the cities cannot get manure, and may have to depend upon fertilizers, but they can grow just as good crops one way as another. It is merely a matter of giving food to the plant. They don't seem to object to the form it comes in, so long as they get the necessary food.

In the matter of seeds, I think it means a good deal to the man who raises his crops under glass. A good deal of the trouble with seeds is due to carelessness. Usually, if the soil is properly prepared and you have all the conditions to make the crop grow, it will grow, and otherwise will only invite disease.

Mr. FRANK WHEELER (of Concord). I will say just a few things about the asparagus question. It is a crop that is adapted to being raised quite a ways from market, and is perhaps one that cannot always be fertilized as well with fertilizer as manure, although it is raised on chemicals a good deal. I have been growing it for the last twenty years for myself and for ten or fifteen years before that for my father, and I have used both chemicals and manure, sometimes one and sometimes the other, for a term of years. I always have claimed, and claim still, that you get better results from your manure and from your chemicals. If you will use them together and not use either one separately; one helps the other. My crop of asparagus has been very good, on the whole. I have not been troubled a great deal with rust, on the whole. I think rust has been a blessing to me personally, because perhaps I have gained by other's losses, — not that my crops are as good now as they were before the rust, but they are much better than the average, and the price received has more than made up for the loss in the crop.

I suppose this past summer I had the biggest stalk of asparagus that ever grew in Massachusetts. It was grown on a bed that is about fifteen years old. It was the last day in the field, and we always cut close the last day. To get the whole of this stalk my men took out the root, I should say nine inches down, and brought it home to me. The stalk was in form round shaped, and at the base was 5½ inches broad. It weighed 18½ ounces. I couldn't keep the stalk, but I have a plaster cast of it.

QUESTION. What variety was it?

Mr. WHEELER. I suppose it was what is called Moore's Crossbred, but it was saved by my uncle from a special plant grown in the field. I would advise everybody not to sow any of our American asparagus seed, but sow the French, as it is much more resistant. The Argenteuil and the Palmetto, I suppose, stand to raise more than any other two.

It has been stated that organization gets very much more attention from the experiment station than one or two farmers. Two years ago we farmers thought there ought to be something done for the asparagus rust, and three of us went ahead and applied to Secretary Ellsworth, the Experiment Station at Amherst and the national government at Washington, asking that they investigate the matter, and they took it up without any urging; so now we have a special station that perhaps in ten years will show a strain of asparagus that will stand the rust better than anything we now have.

Mr. HOWARD. What per cent of cauliflower do you consider ought to head under favorable conditions? What is the per cent of a thousand plants, if you have that many planted? Fall growth.

Professor HALL. I saw one crop this fall that headed approximately 850 plants out of a thousand. In other cases cauliflower may not head over 60 per cent, due to various causes, but with good seed we ought to head 900 or 950 per 1,000 in a good season under favorable conditions.

Mr. HOWARD. How about lettuce troubled with the white feather?

Professor HALL. I am unable to give you the cause of this irregular condition of the lettuce, but I should say, if the soil and everything were uniform, it might be due to the seed. I have often seen lettuce plants growing in a greenhouse where some were much stronger than others, and some had little black spots on the leaf, and in some cases this has been traced to poor or immature seed. When the lettuce seed was gathered, the tips were allowed to seed when standing in the field, and when shaken out all these seeds were saved and put into the lot. The best lettuce seed, I think, are the first ones that develop on a plant. When we find one plant under similar conditions with its neighbor varying or affected by disease, there must be some cause. We often find a great many things which we are unable, even the practical and theoretical man combined, to solve and answer in a satisfactory manner.

I believe there is need of hearty co-operation and more of a brotherhood between the experiment stations and practical growers, — that we need to get a little closer together. I had a little experience with cucumbers last year. I called at a greenhouse in New Hampshire, where I found four or five diseases of the cucumber. I never saw such a crop of cucumbers in all my life. It was a total failure, and the man lost several thousand dollars on it. I took the matter to the station, and they were unfamiliar with it. They took it up, and at the present time are working on some of these diseases. Such things should be brought to the immediate attention of the specialists who are supposed to be trying to help the practical growers solve such problems. If they are not, it is largely your fault as growers for not getting together and bringing these things to their attention and soliciting their assistance.

Prof. H. F. Tompson (of Amherst). I have been studying market gardening, and in looking around have been struck with the business-like aspect of the calling. I was at Mr. Budlong's plant in Rhode Island recently, one of the largest garden plants in the country. He is more in the florist business now, but everything there was perfectly systematized, business from top to bottom. The general farmer's practice has been a hit-or-miss system, and the market gardener has forged ahead because he has been a business man.

My work now is at the Agricultural College, where we are trying to work out something along market-garden lines, trying to teach the men what market gardening is, and how to go at it. I don't believe you can in the college course instruct men to go out and be successful market gardeners unless they are naturally adapted to it. You can, however, teach them the theoretical side of it, and the methods of hunting up the sources of knowledge and of considering the various problems.

Adjourned at 12.10 P.M.

## Afternoon Session.

The meeting was called to order at 2 P.M. by Secretary Ellsworth, who introduced Mr. Augustus Pratt of North Middleborough as the presiding officer of the afternoon.

The CHAIR. This morning we heard a very interesting address and discussion concerning the raising of vegetables. This afternoon we are to go to the root of the matter, and commence with the seed. I take pleasure in introducing Mr. Will W. Tracy, Sr., Bureau of Plant Industry, United States Department of Agriculture, who will address us on "Breeding and raising garden seeds."

# BREEDING AND RAISING GARDEN SEEDS.

BY WILLIAM W. TRACY, D. SC., WASHINGTON, D. C.

It gives me great pleasure to speak here, especially as in my younger days I lived not far from Boston. I am well aware that I am addressing a gathering of the best-informed horticulturists of the country, yet I want to speak first of some of the conditions and general principles underlying modern seed growing, not for the sake of giving information, for you all know of them possibly better than I do, but rather as a foundation for what I am to say.

All plants when subjected to the modifying influences of cultivation, or as a result of cross-fertilization through the flowers, tend to assume distinct forms, which, when of value for any particular purpose, or adapted for any special condition, may be developed into garden varieties of great practical value. Such varieties, in the case of plants propagated asexually, as, for instance, the Concord grape and the Baldwin apple, consist of parts of a single original plant, increased possibly through many propagative generations, but always retaining the potentialities, limitations and tendencies of the original plant, — indeed, are but a part of it; and in some of our courts it has been decided that a tree which as far as can be discerned is identical in every particular with the Baldwin cannot properly be called by that name unless it is such a part of the original tree. Neither does the character change; it was immutably fixed in the original tree, — indeed, in the seed from which it was developed. The Baldwin of fifty years ago, of to-day, and of fifty years hence, is identical in inherent character.

Variation may occur as the result of different environment, but we have only to interchange the different conditions to interchange the variation. The conditions are radically different in the case of varieties propagated by seed here instead of multiple parts of a single individual with identical potentialities and limitations of development; we have different individuals, each with distinct though possibly practically identical tendencies and limitations, and because of this similarity we throw them together as a garden variety; but it is evident that in order to do this we should first have a very clear and distinct idea of the exact type of the plants which shall be so thrown together, and since the varietal name by which the plant is known is determined by its adherence to this ideal, the ideal may quite properly be called the variety. In cultivated plants which are propagated by seed we decide whether any individual plant shall be classed with any variety, not from its origin as with plants propagated by division, but by its character. If from a pod produced on a typical plant of American Wonder pea we take 7 seeds, 6 of which develop into plants of the exact American Wonder type, while the seventh developed into a tall plant like a Champion of England, we cannot properly regard this last as a seed of American Wonder, though it was produced by an American Wonder plant.

The ideal which any varietal name stands for may and often does vary with different people, — often vary materially; while practically the same type is often known by different names, and there is always a tendency to change with time. The Hubbard squash of to-day is very different from that of fifty years ago, and we can only guess what that of fifty years hence will be. These conditions have resulted in a multiplication of varietal names, and a great lack of uniformity as to the exact type which these names stand for, as well as a great want of uniformity of type in the seed sold under the same varietal name.

In Bulletin No. 109, Bureau of Plant Industry, United States Department of Agriculture, we have a record of a critical test and study of garden beans bought from American seedsmen under 502 distinct names; but the author considers that there was among them only 164 really distinct varieties or types, and of these many were so nearly alike that one might have been developed from another by a very few years' selection, — indeed, it is known that some of the 164 lots counted were so developed.

In a recent trial of garden beets, samples bought under 214 different names from the most careful growers of Europe, where the most of the garden beet seed used in this country is grown, and from the most reliable American seedsmen, were carefully studied, and it was found that every beet in the trial could be classed under some one of 20 or 25 distinct types; and this could be done so that the beets so thrown together under each type would be more uniformly of that type and show less variation than those of most of the 214 samples of the trial. Indeed, there were none of the samples in which there was not from 5 to 10 per cent of the roots which were more or less distinctly of a different type from the rest, and in many of them there were 2 to 5 different types in so nearly equal numbers that it was difficult to decide what was the exact type the lot was supposed to be composed of. Again, in some cases seed of the same name was secured from as many as 12 different sources, and it was found not only that the individual samples contained different types, but in such different proportions that it was difficult to decide which type the name should stand for, the majority of the roots in some lots being quite different in character from the majority of the roots in others. Often the only difference between two lots sold under different and quite distinct names would be that, though the dominant type in each would be the same, the proportion of that type would be greater in one than in the other; or, in other words, one was simply a purer and better stock of what was really the same variety as the other.

The varietal names used for different and even for identical types change with time. In 1597 Gerard described 8 distinct sorts of lettuce as common at that time in English gardens. His descriptions of each of these correspond with some sort still in cultivation, though not under the same name by which it was known to him. A. Phillips states that in 1822 some 30 varieties were cultivated in the vicinity of London. Goff, in report of New York Experiment Station for 1885, gives a list of 585 varietal names of lettuce, 257 of which were foreign ones not used in this country, where the remaining 328 were in more or less common use. He found that these 328 names stood for not more than 87 distinct types, and many of these were so similar that they might easily be developed by a few years' selection from the same stock. Bulletin No. 69, Bureau of Plant Industry, United States Department of Agriculture, issued in 1904, nine years later, gives 446 distinct varietal names, but 76 of which are identical with those given by Goff; and the author describes 114 sorts as distinct, of which only 28 were also described by Goff under the same name, though there is not more than a score of descriptions in the latter bulletin which were essentially different from some one given in the first. Of these 114 sorts described in the latter bulletin as distinct, many are quite similar, showing no greater difference than might easily be developed in a few years' selection from the same stock. In counting the number of varietal names in both bulletins every difference in names was counted as distinct, such as Early and Extra Early, Giant and Mammoth, Smith's Eclipse and Jones's Eclipse, etc.; and it is probable that in some cases names so counted as distinct were not intended by the users to be so regarded, but it was difficult to avoid this, for in many cases such differences as Early and Extra Early were evidently intended to stand for material differences in type. Again, Goff may not have listed some names which were actually in use in his time, and were included in the later list; but, making ample allowance for all such cases, we have in the later bulletin at least 150 names which were not in the first in any form, and which we may reasonably regard as entirely new ones introduced during the nine years which elapsed between the publication of the two bulletins.

Now, a seed grower who is exceptionally familiar with varieties of lettuce as now grown in America, and annually grows many tons of lettuce seed, has stated that he did not believe there were more than 25 really distinct sorts now grown in this country; and we think we are quite justified by the known facts in saying that during the more than two thousand years in which we know distinct varieties of lettuce have been grown, there has not been developed in the whole world more than 100 really distinct varietal types, at least not more than that number which were sufficiently desirable ones to warrant their continued cultivation; neither has there been a constant succession of distinct sorts, the better ones taking the place of inferior. Some of the types which have been grown fifty, one hundred, five hundred years, but under different names, being still in use, nothing really superior to them having been developed, yet the comparison of these two bulletins shows that in less than a decade we have at least 150 new names, — more names than there have been really distinct types developed in two thousand years.

We give an illustration of one way in which this comes about, certain facts known to us, but withholding the name of the variety and dealers. A seedsman found in the hands of a German gardener a strain of lettuce which had been very carefully selected and grown by this family for three generations. For at least seventy-five years these people had grown only this one particular type, the description of which had been handed down from father to son, and they had very carefully kept it within their own family. Because of some special obligation the gardener gave some of the seed to the seedsman, who found that it was a remarkably uniform and even stock of a type which had been introduced some twenty years before, and was then being extensively grown under the name A. He grew a stock from the seed the German gave him, and to distinguish this from the other called it B, and under that name sold it to three different seedsmen, one of whom catalogued it as C, one as D and the other as E, each ignorant that it was being listed under other names; and thus a certain type which had been in cultivation at least seventy-five years, and no one knows how much longer, was sold under at least four distinct and new names, and how many more we do not know. A well-known seed grower assured me that he used the same lot of stock seed to grow the cabbage seed which he furnished seven different seedsmen to be sold under seven distinct names; and I might multiply such instances that have come to my personal knowledge indefinitely.

Some of the evils of such a condition are evident, but there are others which, though less obvious, are still more injurious. One of these is the want of uniformity of type commonly found in any given lot, as illustrated in the trial of 214 samples of garden beets already referred to. In more than half of the samples the roots varied so much in form and color that one could only guess at what type the lot was supposed to be composed of; and there was not to exceed a dozen samples in which there were not from 5 to 20 per cent of the roots which were distinctly different in some respect from the balance of the sample. One rarely sees a sample of cabbage in which there are not from 10 to 20 per cent of the plants which are materially different in form, color, earliness or some other respect from the others; and it is only in exceptionally good lots that one can pick out as many as 20 per cent which could be said to be representative plants of the sort.

The use of seed which is uniformly of the type best suited for that particular "culture" (using the term as is done in Europe, to signify any particular field of vegetables grown for some special purpose) is one of, if not the most, important factors in determining the satisfaction and profit to be derived from it; and this is true even if a variation is in itself desirable. It may be a gratification to one's pride and desirable for an exhibitor to grow a superlative individual plant; but a crop which is uniformly of a certain type and quality is far more profitable than one in which a small proportion is distinctly superior. If to a basket of tomatoes of uniform type and size we add a few larger fruits of distinct form and color, we will lessen instead of adding to the salable value of the lot.

In the case of early peas, a difference of a single day in the time they become fit for market will often determine profit or loss; but if to a stock which will mature in forty days we add 10 per cent of one which will mature in thirty-five, though we have hastened the average date of maturity a day, we have not added to the value of the stock; for, if we attempt to pick this 10 per cent when they are in prime market condition, the cost of doing so and injury to the rest of the vines will more than counterbalance the additional price received for the extra early pods, while, if you let them remain until the whole crop is fit and then pick them, they will be so mature as to spoil the sale of the others. I think every experienced cultivator here will agree with me that, in most cultures, if the best and the poorest one-fifth of the plants were uniformly of the same character of growth and quality of crop as the remaining three-fifths, the cost of culture and marketing would be greatly reduced and the profit of the crop materially increased. The man who grows plants for fun or for his cake and pie desires variation, something new, that means surprise and pleasure; while he who grows them for his bread and butter desires uniformity, for that means profit.

I have tried to show the importance of uniformity of type and quality and the sad want of it in most commercial seeds, but I do not want to unjustly accuse our seed growers and dealers of dishonest or at least questionable practices. I have had a somewhat intimate acquaintance with men of the seed trade for the past thirty years, and I unhesitatingly say I certainly know of no class of business or professional men — not even doctors and ministers, whom I have known almost as well as seedsmen — who as a class are more honorable and upright in dealing than they are. They are no more responsible for the evils spoken of than are the seed users. They have come as a result of a general ignorance or neglect of certain principles of plant growth and of weakness of character which are common to all men, — the desire to get something for nothing, to buy at the lowest and to sell at the highest possible price, regardless of real value. The contempt of familiar old things and the desire for that which is new is not confined to seed growers or seed users.

I don't wish to pose as the man with a muck rake, but wish to occupy the balance of my time in suggestion of methods of possible improvement. In doing so I must again ask that you pardon me if I speak of things already well known to you.

Every plant grown from seed has a certain definite and changeless character which was inherent in the seed from which it was grown, and is made up of the balanced sum of different tendencies, potentialities and limitations of development inherited in differing and varying degrees from each of its ancestors back for an indefinite number of generations, plus more or less influence from climatic and other conditions affecting the development of the seed-producing plant. Generally the influence of the immediate parent or seed-producing plant is the most dominant, but not always, its relative dominance being influenced in several ways, one of the most important being the degree to which the character of the producing plant is in accordance with the general character of those of preceding generations. Practically all the seed of a plant which is in every respect exactly like all of its ancestors for many generations will develop into plants like that which produced it, while only a small proportion of those produced by a plant which is materially different from its ancestors will be like the producing plant; but if the majority of its ancestors were alike, the majority of the seeds produced will be like them rather than the plant, while the remainder of them are apt to assume a great variety of forms. These conditions account for the fact that seed of selected plants of marked and exceptional excellence generally fail to produce plants like the seed parent, but are apt to give those like the run of those of earlier generations, together with some wide departure from it; and also make it clear that, for the production of seed all of which can be depended upon to produce plants of any exact type, we must have plants which are not only of that type, but which have descended for the greatest possible number of generations from plants of precisely the same type.

There are, however, other facts which should be considered. One is that, while tendency towards any distinctive characteristic of the producing plant or of that of any previous ancestor may be overcome by that of the general run of influence and become dormant, yet it is not destroyed, but may crop out in any subsequent generation; and when it does so there is apt to be a wide variation from the general type and in many directions. This tendency to crop out, though never entirely obliterated, grows weaker and weaker with every generation; and so we should endeavor to bury it beneath the greatest possible number of generations of the desired type. Again, it has been found that often under the abnormal conditions of cultivation, particularly under glass, there comes an inherited lack of vigor, diminished size and increased liability to disease; and that all of these are counteracted by crossing through the flowers with some distinct variety, particularly if it be one nearer the original type of the species. This results not only in increased vigor, but in a great diversity of type; though there are always some of the plants which retain the type of the variety, plus greatly increased vigor, and these can be used for the starting of a new and invigorated line of descent without a change of type or of name, unless it be that it be known as reinvigorated stock of the old variety.

Again, we often have prepotent plants or those which have exceptional power to transmit their own characteristics, independent of that of the general run of inherited tendency. It is clear, then, that for the production of seed every one of which is likely to produce plants of precisely the same type we must first have not only an exact conception of that type, but that such conception shall be so recorded that we can exactly follow it in our selection for many years, and it is very desirable that this conception should be designated by some universally accepted name; and, second, we must each year select not only plants of that exact type, but of proven prepotency or tendency to produce plants of that type. This necessitates not only the saving of seed from each plant separately, but the testing of its relative prepotency and the use of only those plants which have been proven to be strongly prepotent. This involves the testing of seed of each plant before it is given a place in the hereditary line. Even after by this method we have developed a stock of satisfactory unity of type we cannot safely rest, for such stocks, no matter how carefully grown, tend not only to lose in vigor but to degenerate through accidental crossing; and the process of building up a stock from prepotent individuals of the right type must be constantly repeated, so that we may have a fresh stock but a few generations from the selected prepotent individuals of exactly the right type to take the place of the degenerated ones. It is evident that it is impractical to produce all of the immense amount of seed required for use in this way; but I do know that it is quite possible and practical to so produce all the stock seed from which the seed actually used by the gardener is produced, and that efforts in this direction will give results of incomparably greater practical value to actual vegetable growers than the effort to produce entirely new and distinct variations. There is, I believe, no probability of even a Burbank being able to furnish us, whether it be by development or "creation," with a variety of lettuce which shall be of greater practical value than some of those which have been developed during the more than two thousand years that the plant has been grown in gardens; but I think it is possible to produce a stock of any of the distinct types now in existence which, because of greater unity of type, shall be greatly superior in practical usefulness and can be used with greater satisfaction and profit than any new type which is likely to be developed. Indeed, I believe your townsman, W. W. Rawson the vegetable grower does produce for use in his own gardens just such stocks, though I do not know whether W. W. Rawson the seedsman sells them or not; but, if not, it isn't because he fails to appreciate their value, and that no matter what they cost it is more profitable to use such strains of well-tested types than more carelessly grown and cheaper stocks or to experiment with new sorts. We believe it is entirely practical to produce such superior strains of all of our garden vegetables, and that their more general production and use would increase the profits and satisfaction of both the seed growers and the seed users.

I know of a case where the seeds of 10 watermelons of identical and very superior character were saved separately, and samples from each lot were planted, and the one in which the fruit was most uniformly of the distinct type was selected and planted in an isolated block, and produced sufficient seed to plant a field of 20 acres. This was without exception the finest field of melons I ever saw. At the time when the fruit was nearly ripe, and not a melon had been taken from it, I could find in a half day's careful search only about 50 melons which were different from the desired type, and with fully 75 per cent of the fruit one specimen could not be distinguished from another. The field yielded over 5,000 pounds of seed, and, though it was grown on contract at a low price, the seed crop was satisfactory to the grower, the seed was profitable to the dealer, and the planter was pleased with the fruit he produced from it. This lot furnished an illustration of the necessity of constantly renewing stocks from prepotent plants of the right type. The general stock was so good that it was used for subsequent seed crops, no special selection of stock seed being made; and as a result some years later I saw a crop of the same variety on the same field, and instead of 50 fruits slightly off there were nearer 500 more or less different from the "off," and often really more like some other variety. The field was badly blighted and the yield small, so that it was a disappointment to grower; the seed a loss to the dealer, as it was not readily salable, because of dissatisfaction with the seed grown the year before; and the returns from it most unsatisfactory to the planter. I think this case shows that it is not only possible but practical to produce seed of high quality in large quantities, and that it pays to do so. I am sure that there is no way in which our horticultural practice can be more profitably modified than in the production and general use of seed of the best quality. In different ways different classes of horticulturists can aid in this work: —

First, horticultural students, particularly those of our national and State experiment stations.

Second, the seedsmen, particularly as united in organization, like the American Seed Trade Association.

Third, our horticultural press.

Fourth and last, but by no means least, the practical growers and dealers, whether they be home gardeners, market men or truckers.

Each of these can help along separate lines. Our horticulturist can study and classify the possible and profitable variations of each species, such as disease resistance, hardiness, adaptation to different soils and climates, those affecting shipping and marketing qualities, and especially the forms, colors and shapes of plants, leaf and fruit which go with and indicate such qualities. They can make a study of the innumerable varietal names which are now in use and what they stand for, and throw them together under a few which shall stand for each distinct type, which type shall be most minutely and accurately described with mention of every desirable and undesirable quality, as fitting the sort for special and different uses and conditions. It may be said that varieties are already fully described in our seedsmen's catalogues, but I do not think they are, or that we ought to expect to find accurate descriptions there. The seedsmen publish and distribute these catalogues at great expense, and they do so primarily for the sake of selling the seed they offer. They answer the purpose for which they are designed in proportion as they secure orders for seeds. Will this be measured by the accuracy and completeness of their descriptions? Whatever your answer may be, the answer given by the catalogues themselves is an emphatic No. Looking through the 1906 catalogues of 125 seedsmen who list Davis wax bean, we find that 77 speak of its good quality, 82 speak of the beauty of its pods, 96 speak of its vigor and productiveness of vine, 30 call it stringless, and only 7 admit that it is stringy or not of the best quality. Now, this bean has been in cultivation long enough so that everybody knows of its character and value; and I ask if a description which fails to mention the distinctly stringy character of its beautiful pod can be called complete? This is not an exception, but a typical case; very rarely is any quality which could be considered as a defect mentioned, while those which are valuable are spoken of in exaggerated terms of praise.

It may be argued that the variety trials at our experiment stations already do this work. Some of them are doing most excellent work along this line, but in many cases such trials are really but a study of seedsmen's names for different stocks, rather than a study of the actual varietal types of the vegetables themselves and their usefulness for certain purposes. The seedsmen can do a great deal, and I think with great profit to themselves. They can, especially through the

Seed Trade Association, exert a powerful influence against the practice now quite too common and regarded with too much leniency, of mislabelling stocks and selling them for what they are not. They can do a great deal towards the establishing of clearly defined variations or types and the general acceptance of them, and of the names by which they shall be known as standards with which all other variations can be compared. They can discourage — indeed, they could if they would practically put a stop to — the present practice of using entirely distinct varietal names for stocks whose only difference is the degree to which they are free from mixtures, and are made up of plants which are good specimens of the same type, thus using varietal names to indicate quality rather than type. I believe that the present multiplication of names and the want of definitions of the type for which they stand are chiefly due to this practice, and that if it could be prevented it would be of immense benefit to all who deal in or use seeds. Lastly, but by no means least, it is entirely practical for them, through the use of better stock seed procured as was the watermelon seed referred to, to greatly improve the uniformity and adherence to type of the stocks they offer.

The horticultural and general press can help the user of vegetables to a better understanding of real values. It has been truly and tersely said that "the American tastes with his eyes," and it seems to be true, at least as far as vegetables are concerned, for appearance, both on the dealer's stand and the user's table, has a far greater influence in determining popularity than quality. A handsome sort which shows up well will outsell both as to quantity and price one which is of much better quality though less attractive.

Lastly, the gardeners and actual seed users can do more to bring about an improvement in the quality of the seed sold than can any one else. Many gardeners act as if, though seed were essential for the raising of the crop, they were so only in the same way that manure or water are essential, the only important thing being that they will grow. They want seed and plants of a certain name and type, but do not act as if they knew that the degree to which all the plants grown from the seed will be of the desired type is bred into and immutably fixed in the seed itself. With most gardeners the price at which seed is offered, provided only that it is called by the name by which they know the type and is of good vitality, has more influence in determining the source of their supply than the certainty of its being uniformly of the exact type wanted. Many gardeners are always looking for some new and improved variety. They will pick out a plant which is simply an ideal specimen of the old and standard sort they have, and say, If we could only get a variety which was all like that, we would willingly pay most any price for the seed. But the seedsmen who has by careful selection developed a stock of some standard sort which is a great improvement in uniformity of type knows that if he offers it simply as a superior strain he will find it difficult to sell it at a price which will compensate him for his extra labor; but if he offers it under a new name, and describes it by a glittering scintillation of superlative adjectives, which give so little real information that the identity of the type is not suspected, he can sell much more of it and at a much higher price than he could if offered for what it really is. Rival seedsmen soon discover the identity and offer their strain under the new name, or a still different one, and the multiplication of names and the mixture of types goes merrily on. If seed buyers would only be willing to guage the price they pay more by the quality of the stock and less by claims for novelty, there would soon be great improvement. Gardeners should also be more willing to recognize the fact that, independent of the stock, there is often a great difference in the cost of growing seed of different varieties of the same species. Some of the most useful sorts that have ever been developed have practically gone out of cultivation, or at least are not offered by seedsmen, simply because it is so difficult to grow the seed that they cannot afford to offer it at the same price as that of other sorts, and gardeners refuse to pay more, at least after the sort has ceased to be a "novelty." Naturally, a seedsman pushes the sale of the sort which can be produced most profitably, rather than one which, though of really superior value, can be sold only at a loss.

This suggests the practicability of the gardener himself growing the seed he needs. Can it be done, and how? I would answer that I do not believe that a gardener can profitably grow a general collection of seeds, but I do think that in many cases he can grow seed of one variety of the species of which he makes a specialty, and produce seed far superior to any it is practical for the seedsmen to furnish him; for not only does he know just what he wants, but he can give more care to selection than it is practical for the seedsmen to use with any but his stock seed. Again, in many cases seed produced in any location will give better results in that location than seed grown elsewhere, and, as the seedsmen get their stocks grown in the section where because of local climatic soil or industrial conditions it can be produced at least cost, local-grown seed is superior; and so, though it may be something of a repetition, I want to speak of how it is possible for the gardener to grow seed most likely to uniformly develop into plants of desired type. First, he must form a very clear and exact conception of precisely the plant wanted, and this should be very fully and accurately recorded, and, if possible, the records supplemented by photographs. I regard this exact description and definition of the desired type as very important, — indeed, as the very foundation stone of all successful seed growing. Without it one is very apt to vary more or less in the type of his selections even the first year, and certain to do so in subsequent ones; and variation of type in the stock seed plants, even if the variation is in itself unobjectionable or even desirable, is fatal to uniformity of type in the market crop. Having selected a few plants of the desired type, the seed from each of these should be sowed separately and a sample of it planted, in order to select those plants which show the greatest prepotency. If these growing tests of seed from the different selected plants are carefully studied with our description of type in hand, it will often be found that there is a great difference in the uniformity of adherence to the desired type, and often seed from what we considered the very best plant will develop into plants showing the greatest variation of any; and, if so, that lot of seed should be ruthlessly rejected, even if it contains the very best individual plants of any, and we should select for our breeders the plants whose seed uniformly develop into plants of the true type with the fewest which show variation. This preliminary test will often delay us a whole season, but in my experience it is time profitably spent. The seed from the selected plants may then be planted for the production of seed. It is better that each lot be isolated, though this is not always practical; but they can always be planted by themselves, even if they have to be side by side. This enables us to verify the preliminary test as to prepotency, and to reject any lot which shows much variation. From the lot which is most uniformly of the right type, the original description in hand, select plants to start another line of selection. It is much better to take all those select plants from the best lot, rather than the best plants from all the lots. After making the selection for further breeding the lots can be gone over, and any plants, or even all those from any parent plant, which are not of the desired type should be rejected. In many cases the seed from the plants retained will be sufficient for the planter's use; if not, it can be sowed collectively and used as stock seed for the production of the required amount. It may be said that this plan of rigid adherence to the original type blocks any improvement; it certainly does, if improvement involves change of type. But I will say again, and I promise you that this will be the last time, that uniformity of type is the most important quality determining profit, and that this is determined more by heredity than by individual excellence.

The CHAIR. Mr. Ross is one of our most extensive seed dealers. We will be pleased to hear from him.

Mr. WALTER D. ROSS (of Worcester). Mr. Tracy has answered about all the questions that we could attempt to ask; but there was one point that impressed me very much, — about statements seed dealers make in regard to descriptions. We would be only too glad, I think, — I say we, — to state facts and give as nearly as we can the exact descriptions, if the public would only follow the advice Mr. Tracy has given; but, as a matter of fact, the public don't want us to state the facts always, — they want us to go a little bit beyond, and make them believe a thing is a little bit better than it is. As a matter of fact, as Mr. Tracy has said, some of the very best varieties have practically no sale because of the color or because of description.

Mr. W. W. Rawson (of Arlington). As my name has been mentioned, I think perhaps I better say a word in regard to whether I sell the same seeds I grow. That is the kind I sell, and what I went into the business for; because I can produce better seeds than a gardener can produce himself, nearer the top, and keep to it. Let a gardener take seed and grow it year after year, and it will deteriorate to such an extent you won't know it in a few years; but let a seed grower take it and grow it year after year, and make a business of it, and he will get something that is better than what he started with. I have always tried to grow my stock seed as far as possible and send them to the best growers in the country that I could get to grow them, and to that locality to which the seed is particularly adapted. In that way you get good seed to sell. As to having different kinds of seed, we do; we have to, or we couldn't sell them.

If you buy of three or four seedsmen, that settles it, — the seedsman has the advantage; but if you buy from one place and have the name on the back, so you know where you got them, you are pretty sure of getting good seeds.

I will say a word in regard to the catalogues. We have got to tell the thing just as it is, and then explain it a little more. That is just what the people want, and the seedsmen try to give it to them. We are getting educated, just as well as you.

You will notice on the last day of the programme you are all invited to visit my place in Arlington. I shall be glad to have you all come, but I cannot show you what I would like to show you, because it is the very worst time of the year for you to come. But if you see it at the worst time, perhaps you will come again when there is something more to see.

The Chair. I had the pleasure of visiting Mr. Rawson's place several years ago, and it is a great treat to look it over and learn what he has been doing. I hope you will all avail yourselves of the opportunity to accept his invitation, and see his grounds.

This morning the speaker told us, when we found a strain of good seed that we were satisfied with, to buy largely and buy even more than we wished to use that season. Isn't it a little dangerous sometimes to buy some seeds, — whether they will keep good for several years or more than one year?

Mr. Tracy. The question of how long seed will keep is a somewhat variable one. I have used vine seeds that were sixteen years old and turnip seed twelve years old, and got a perfect stand; onion seed two years old, and got a better stand than the average of seed only one year old. It depends largely on the species. Some species retain their vitality a great deal longer than others; but a seed with good vitality primarily, when it was harvested, will retain it a good deal longer. If I were growing seed commercially, I would want to test my seed and hold it over a season.

Mr. Rawson. As to the question of seed, I would allow that all vine seeds are better, the older they are, up to ten or fifteen years old. They have a tendency to produce more fruit and less foliage. I try to keep my cucumber seed and squash seed as a general thing two or three years before I sell them, because they do produce much more fruit with much less vine. As for beans, you can grow the best quality and grow a very prolific crop when ten, twelve and fifteen years old. I have done it many times, and they were all right. The cabbage seed will not produce so large a foliage three or four years old as it will one, but will produce a better head. So will lettuce seed. There is only one really that we have to throw away when we have any left, and that is the parsnip seed. The carrot seed will not run to so much stalk after two or three years old, but is good to five or six. There are many seeds that work in that way, and the seedsmen know what the stocks are. They have had them from year to year, and those who intend to carry them all the time know just what they are selling.

Mr. Tracy. I think it is very desirable that our market gardeners come into more intimate and confidential relations with the seedsmen. You can get seed from various seedsmen, and plant them; very little trouble, — I don't mean an extensive amount; then notice carefully the quality of the stock which you are furnished. Communicate with the seedsman, and find out where you can get the best stock, and, having got it, make him your confidant and tell him what you want, and criticize his seed, if you choose, and in that way get into touch with somebody who will furnish you just the kind of seed you want, and then stick by him. Don't be tempted by a flaming advertisement of the great superiority of something that has never been produced before, but stick to your seedsman.

Mr. H. T. Horton (of Rehoboth). Oftentimes a man gets a great deal of satisfaction from saying that he raised that particular seed in addition to hoeing, weeding and all that sort of thing. In that way he gets satisfaction which he wouldn't by buying new seed every year. I want to know whether or not it would be best to advise that man not to attempt that, but to buy new seed each year, — whether he does really get any satisfaction out of it in the end?

Mr. Tracy. If you will confine yourself to one line, fix upon one thing that does please you, that is in accordance with your idea, and will breed to that, you will be enabled to get an infinite amount of pleasure out of it, and great comfort. If you experimentalists will get a type in mind which you want to produce, and then breed to it, you will find satisfaction in raising your own seed. Or, if you want to experiment, and all you want to see is a new thing, which is a pleasure and a surprise, and you enjoy it, why you may do so, but it is a loss to the practical seed grower. You can cross any infinite number of things, and some will be curious and will always give pleasure; if you are after that, you can get it through that sort of experimentation. But I was speaking in regard to profits on your produce, and then it is best not to experiment.

Question. You spoke of keeping seed five, ten and fifteen years. Under what conditions would you keep them?

Mr. Tracy. Cool and dry, with as little access of air as possible. It has been found that the two things which cause the most damage to seed are heat and moisture, taken separately or in conjunction.

Mr. H. M. Howard (of West Newton). This morning I was asked what per cent of cauliflower should head under favorable circumstances, and Mr. Hall, I believe, said it might be 850 out of 1,000, and I believe Mr. Tracy after the meeting was speaking to me of a case where he had known as high as 950 out of 1,000. Now, I would like to know why it is that so much cauliflower seed is put upon the market where not over one-half will head, and how can we get more of that where 95 per cent will head? I, for one, would like to get hold of it, and would be willing to pay more than double the price per pound I now have to pay.

Mr. Tracy. What I said this morning was in speaking of a field I saw recently while spending several days on the east end of Long Island. As you go through the country there you see a field of from one to five acres of cauliflower, as often as you would in Michigan one to five acres of corn, and it is the main crop at this season of the year. I think there were few fields all along the east end of Long Island that we went into where they did not get as much as 85 per cent merchantable heads, and the majority of them got over 90 per cent. The reason they get a better development there is because of the peculiarities of that east end of Long Island soil. It is a peculiar, exceedingly well-drained soil, which is made quite fertile by a liberal application of manure, and, having water on both sides of it, the atmospheric conditions are exceedingly favorable. Acres after acres are grown, and will be much more compact in growth than any I have ever seen in the vicinity of Boston. A year or two ago I was looking over the market gardens of Boston, and remarked, "I don't see how you can produce any cauliflower here at all; the plants are too large." Most all reputable seedsmen get their cauliflower seed from the same sources, so there isn't a great difference in the quality of the seed; but I think there is a great difference in the local conditions which develop the crop.

Mr. Ross. Is that also true in regard to celery?

Mr. Tracy. It is to some extent. Certain varieties of celery, particularly the self-blanching types, the California seed, do have a tendency to produce pithiness; at the same time, I have seen other cultures show little or none of it. My own impression is that certain varieties, particularly the self-blanching types, do have a greater tendency to produce a bulky pithiness than does the French variety.

Question. Where is the best place to produce Brussels sprouts seed, in this country, or England or Scotland?

Mr. Tracy. On the east end of Long Island where I visited they grow a good many sprouts, and one or two of our best strains are grown down there. I do not know whether they are offered by a seedsman or not. I know they have been, and I know, to go back, that there has been just as good quality of sprout seed produced in this country as ever came from Europe, and I think that I should answer that question in that way. If I had my choice, I should prefer American-grown sprout seed.

Question. Do you think it is a good policy to buy all of your seed of one seedsman, or different seedsmen?

Mr. Tracy. That is pretty difficult to answer. My own tendency would be to get into intimate relations with some one seedsman, to get into understanding with him, and let him know that I would rather my order would be declined than that he should send me anything but the best, and then make my purchases generally from one seedsman. That would be my practice. Other people with different tendencies or temperaments would prefer to buy from different seedsmen. I would first, however, experiment with the seeds from different sources, and, having satisfied myself of the integrity of some one seedsman, my tendency would be to confine myself to him.

Mr. Lewis. I buy seeds from about ten different houses through the year, over different parts of the State. With my experience in buying seeds I find it better to buy different seeds from different seedsmen, as their particular type may be better than some others. I have taken a particular type of carrot, and I have taken three or four different kinds and tried one beside the other, and in making a selection in that way I find some of the types vary a great deal; and I have come to the conclusion, in reference to that, that it is best to buy one particular kind of seed from one particular seedsman. Take squash seed; I have had some experience in buying of different seedsmen, and I have come to the conclusion that some seedsmen have better squash seed than others, — their seed is cleaner.

Question. Can you tell us how to avoid the bean weevil?

Mr. Tracy. The seedsmen rarely depend on a location as far south as Ohio for a crop of beans, because of their being subject to the bean weevil. The beans grown further north are practically exempt. The only way that I know of to prevent them, if you want to raise beans in a section which is infested with the bean weevil, as nearly all sections as far south as Ohio are, is merely in saving seed to put them in a closed receptacle and add some bi-carbonate of soda, which will destroy the weevil in the beans, and after a week or two I would give them another dose to destroy those that have hatched out, and keep them in a closed receptacle or dish. It is not the same weevil that attacks the pea, and the bean weevil lives over and propagates in the dry seed, whereas the pea weevil has to be propagated when the pods are in a growing condition.

Mr. Lewis. Do you think farmers have proper protection in buying seed from the different seedsmen? We have trouble a great many times with seed not germinating. Seed we buy for last year's seed I think a great many times is older seed.

Mr. Tracy. I will simply say that I think it is very desirable for people to test their seed before planting it, but the testing of seed as to vitality even is not the simple thing that it has sometimes been represented to be. Very often people making a test of seed for vitality will get a misleading result. The lettuce seed, for instance, is very susceptible to too deep planting or to too much moisture, and two lots of seed planted side by side, one in normal conditions and the other in a little excessively dry conditions, one will seem to be in a good deal better vitality than the other, whereas the vitality, provided you have the suitable conditions, is about equal. I should test seed from different sources, and I would be guided by the result of my vitality tests in my purchases very largely; but I don't think many seedsmen intend to sell seed of low vitality, — reputable seedsmen, — and I think their tests are generally more reliable than the tests of the ordinary user.

Mr. William H. Bowker (of Boston). I think the young man [Mr. Lewis] has struck the pith of this matter. I do not think the gentleman from Washington quite understood the point he was making. The question, it seems to me, is this: Shall the seedsmen be obliged by law to guarantee the purity and vitality of their seeds? Why should not my friend Rawson be obliged to "state what he sells and to sell what he states" in connection with seeds, as I am obliged to do in connection with fertilizers? For over thirty years the fertilizer manufacturers in this State have been obliged to guarantee the quality of their goods; to pay license fees for the privilege of doing business in the State, which license fees have paid the cost of inspection. State inspectors have drawn samples in the open market, carefully tested them, and put us on record, and I want to say that it has been the best thing that ever happened to the industry. No reputable fertilizer manufacturer would to-day do away with official inspection. Shall the seedsmen be held up to the same sort of inspection? Shall we have a department at Amherst for inspecting seeds, the same as we have for inspecting feeds and fertilizers, and the same as we have in the office of the Board of Health for the inspection of milk? I would like to ask the gentleman from the Department of Agriculture in Washington if he would suggest that we conduct at the experiment station a line of tests that would bear directly not only upon the purity but the vitality of seeds? Should we attempt, as they did in Iowa, to test, for example, the corn which is sold and planted in the State? In Iowa I think they found samples of which only 50 or 60 per cent would germinate. If the farmers could be sure that at least 90 per cent would germinate under normal conditions, would it not be a tremendous help to them?

Mr. Tracy. I am willing there should be a law compelling the seedsmen to guarantee the seed when it leaves his hands, — guarantee that it shall have a certain vitality; but I do not believe it is fair or equitable to hold a seedsman responsible for what happens to the seed after it has left his hands.

Mr. Bowker. That is where you are right. It would be entirely unfair for the dealer to guarantee the seeds after they have left his hands, for too many conditions enter into the matter of germination which are beyond the control of any one. My point is this, that we should have a law in this State which requires that seeds shall be subject to inspection, the same as fertilizers, milk and food products; that seedsmen shall guarantee the purity and vitality of their seeds at the time they leave their hands; that all seeds shall be tested under certain prescribed conditions, which shall be fair to all concerned.

Mr. Ross. We have a national seed law now, and a State fertilizer law. The latter I believe is all right, and I don't believe any seed dealer will object to a State seed law similar to the national law. When we have a State law that protects us when a person, unknown to us, can get a sample of seed and have it carried through the mails and examined without our knowing it and without giving us any redress, then we will be perfectly satisfied with the law. We received a statement this morning from Washington that two-year-old onion seed tested better than one-year-old, but we don't know what the result will be when the seed is put into the ground. If anybody wants to make an examination of seeds, we are willing to have them go; but in case of an accident, leave a sample of the same, so we can have the advantage that the fertilizer men have, — not have it all on one side.

Mr. Tracy. Often you buy seed from your seedsman early in the season, and you go out and plant it, and there comes a cold, wet time, and the seed doesn't do well, and you say that seedsman was a fraud, and you never buy of him again. You go to another man on the next corner, and you plant again, and that season, after it is planted, nice warm weather comes on, and it does splendidly, and you say, "That is the man; I will buy of him," when it is nothing in the world but accidental conditions. It is true the men ought to know that, and ought to think of it; but there are a great many things we ought to do and ought to keep in mind when we judge people. In judging anything we are apt to forget things we should remember, and be overcome by prejudice, or accident, or circumstances.

Mr. Bowker. We had in this State twenty-five years ago a general fertilizer law. It was just as good in effect as the law of to-day, because it required that we should state what we had, but there was nobody who could enforce the law. It didn't provide for the machinery, and inspection, and analysis, and publication, and that is where the difficulty was. Now we may have a national law, a United States law, governing the matter of seed; but if there is no system to enforce it, you don't get the results that you ought to get. My point is this: I would like to put this direct to the speaker, — would he favor a State law controlling the futurity and vitality of seeds, with the machinery of inspection, an inspector to inspect them, and the testing all done under similar conditions with that in other lines? The dealer should not be held responsible after the seed leaves him, but it seems to me he should be up to that time when the seed leaves his hands, the same as a milk dealer is, or the same as I am.

Mr. Tracy. If I am obliged to answer, I want to answer entirely from my personal standpoint. I am known to be connected with the Department of Agriculture, and I don't want to speak in any sense officially; but it does not seem to me that it is practical and possible to have the same sort of a law of guarantee that we have with our fertilizers; that is, that seed shall be sold with a branded guarantee of vitality, except as to its condition when it leaves the seedsman's hands. That, of course, involves a great deal of expense and a great deal of machinery, and would cause an additional expense for seeds. I have known over and over again of where seedsmen have had lots of seed they were unwilling to sell, and had rejected as not fit for use; but farmers come in and say, "Why, this John Smith down here offers seed at half the price you are asking," and the seedsman said, "Well, I have some here I can sell at that price, but it is a low quality," and the farmer has, with that knowledge, bought that poor seed rather than pay the price for the better seed. I have known of such an instance, and I think all you can ask of the seedsman is to state the vitality as it leaves his hands. I state this entirely unofficially, simply as my personal view.

Adjourned at 4.15 P.M.

## SECOND DAY.

The morning session was opened at 10.30 o'clock by Secretary Ellsworth, who introduced Hon. Frank Gerrett of Greenfield as the presiding officer.

The CHAIR. You have as the gentleman who is going to address you this morning Prof. Thomas Shaw, northwestern editor of the "Orange Judd Farmer," who will speak on "Breeding and managing dairy cattle." I am glad that so many of you are here to greet Professor Shaw, and listen to what he has to say.

# BREEDING AND MANAGING DAIRY CATTLE.

BY PROF. THOMAS SHAW, ST. ANTHONY PARK, MINN.

More than twenty years ago the cry went up that dairying would be overdone almost to the extent of rendering the products of the dairy valueless. The attention of the various agricultural colleges began to center on dairying as on no other department relating to live stock. The farmers institutes, like the colleges in the prime of a robust youth, gave more attention to the gospel of dairying than to any other gospel. Likewise, more space was given to the dairy in the agricultural press than to any other topic. Assuredly, on the surface at least there were grounds for the fear that dairying would be overdone. But what are the facts? Simply these: there never was a time in the history of the United States when dairy products were relatively so scarce and dear as they are to-day. There never was a time when dairy cows would sell at so high a figure, and there never was a time when the cry for dairy workers was so loud as it is to-day. The reasons why it is so are not difficult to find. This is true at least of some of them. They include the following: (1) the average dairy cow has not been so improved by breeding and selection as to make her too valuable for early slaughter; (2) many high-class dairy cows are injured for dairy production and for breeding by being overfed; (3) the amount and constancy of the labor involved in dairying makes it distasteful to many as a pursuit. Nor is the fact to be overlooked that with the great improvement made in the product during recent years there has come, as was to be expected, an increase in the relative consumption of these products.

## Breeding Dairy Cattle.

The subject of breeding is a great deep, which in many of its phases has never yet been fathomed. But it has its shallows as well, and it is in these that I propose to conduct my search. Aside from the laws or principles which govern atavism and correlation are two laws or principles, some knowledge of which is essential to the successful breeding of farm animals. These are: first, the law or principle that like produces like; and second, the law or principle that like doesn't always produce like. Some claim that these do not have the strength of law, they vary so much in the results. I will not argue that question here. It is sufficient for my purpose to know that it is within the power of the breeder to accelerate likeness of transmission, or to retard it. Once grant this, — and it cannot be denied, — and you at once give the breeder the power to raise the standard of his herd.

Certainty in likeness of transmission is increased, at least up to a certain limit, by increase in purity in the blood; by increase in prepotency, in the sire especially; and by the continual weeding out and discarding of undesirable variants.

The advice is freely given to those who desire to improve their herds, that they shall do so by using only a pure-bred sire, well chosen as to his individuality. This advice is based on the observed fact that resemblances to such a parent in the progeny are greater than could be looked for from a male of mixed breeding. Theoretically, every generation added to the pedigree would add to the certainty of the transmission; but this may not always follow, because of variations that occurred in the ancestry. The comparison between using sires of pure and mixed blood may be stated as follows: from the pure sire there may occur some variations that are not desirable; from the other sire they will certainly occur. In the former blood, elements have been strengthened and made dominant in transmission through repetition; in the latter, they have not.

If, therefore, length of pedigree beyond a certain limit is not an infallible measure of the value of pedigree, what is the measure of such value, viewed apart from the individual form? I answer, performance in the near ancestry. Whether to man or cattle beast, it means much more what the character of the parentage was than what the character of the grandparents was. To either, likewise, it means much more what the grandparents were than the ancestors of say ten generations previously.

Fortunately, dairymen have some methods opening to them whereby they can measure performance in the near ancestry more unerringly than this can be done with some other kinds of live stock. The record of the animal, if a female, at the pail, is that measure; and if a male, the measure consists in the performance of his progeny at the pail, providing time enough has been given to furnish such testimony. If such performance can be satisfactorily traced, through even a limited number of the ancestry, and more especially the near ancestry, the choice of such a sire is not likely to be disappointing. But, you ask, does individuality — that is, form — count for nothing? It counts for much, — so much that without it in fair degree the animal should be rejected for a sire. It is not the intention, however, to discuss form as such in this paper.

After breeding and form comes prepotency. Prepotency is the ability to transmit breed and individual characteristics to the progeny. Marked prepotency is of rare value in a sire, and, like all bestowments of rare value, is not very common. Instances may be cited in which such potency in a single sire has brought with it in a sense fortune to the owner. Of course such potency can be assured only by actual test, and to wait for such test may involve the purchasing of mature males only, that have reached or almost reached the meridian of usefulness. How may this difficulty be met and overcome?

Three guaranties exist of probable prepotency before it has been proved by actual test: the first is descent from an ancestry of good performers in the near branches of the same; the second is the presence of line blood in the near ancestry; and the third is robust individuality.

Descent from ancestry who were good performers has already been discussed. Line-bred animals are such as have been bred for a number of generations within the limits of a certain family. Thus an animal with only St. Lambert blood in it for a number of generations would be a line-bred St. Lambert, and the intensity of the breeding will be dependent on the closeness of the relationship in the parent tree. Such affinity strengthens potency in transmission. When carried too far, it may lower stamina, but this point is carefully guarded below.

It was stated that the individual should have robust individuality. This does not refer so much to the form as to the action that may accompany form. A Southdown ram carries his head high, his eye is alert and his step is easy and without effort. These things are present because he is robust; and because he is robust he is likely to prove an impressive sire when this possession accompanies purity of breeding, and to some extent when it does not. The same things may be said of that Jersey or other sire that is so full of life as to be in a sense irrepressible.

But all the indications of potency mentioned may be present, and yet the animal may not show marked potency. This does not often happen, but it does in some instances. One sire bred in a certain way has become famous, and a full brother of the same has shown no marked potency. Because of this, the mistake should not occur of introducing a sire into a herd for extensive use in the same without first having his prepotency tested in a limited progeny.

From what has been said it will be abundantly apparent that the advice which urges the use of pure-bred sires only in herds where heifers are to be grown into cows is good advice. The grade bull has no blood elements that may be considered dominant. How, then, would it be possible for him to transmit them? Two methods of improving grade animals have been sought: the first of these seeks improvement through what is known as grading up; and the second seeks the same by making frequent crosses. The immense superiority of the former system will now be shown.

### Improvement by grading up.

Improvement by grading means that only sires of one pure breed shall be used during its continuance, and that the improvement secured will be strengthened from time to time by calling out and rejecting for breeding uses any inferior animals that may appear. And just here it may be said that, as a rule, the more common or mixed the blood elements in the foundation females when such improvement begins, the more rapid relatively the improvement. The explanation is not difficult. By this system improvement is mainly sought through the male. His power to effect change in the line sought comes from his prepotency, and his prepotency from his inheritance. The more prepotent the sire, the more rapidly will he effect improvement.

The improvement sought comes mainly from the sire. Each additional infusion of alien blood in the near ancestry of the cow weakens her potency in transmission. In other words, it aids potency of transmission in the male by weakening the resistance in the female. When, therefore, the ordinary owner of cows sets out to seek improvement, usually he cannot do better than use such stock as he has to begin with; but the males introduced ought to be good individually, and chosen successively from the same breed.

See how quickly improvement may be effected. Suppose the foundation females are of the class described, and that the sires chosen for the improvement sought are of the Holstein-Friesian breed. According to the theory that the male is half the herd, 50 per cent of the elements of inheritance would come from the sire, and a similar per cent from the dam. But the prepotency of the male is much greater than that of the female, for reasons given. More than 50 per cent of the elements of inheritance will come from the sire. The preponderance in the elements of such inheritance will be proportionate to the preponderance of potency in the sire. While no one can state in any given instance the mathematical proportions of the inheritance, it would seem safe to conclude that 75 per cent at least of these elements have in the case supposed come from the sire. This explains why the inheritance of form and color much more nearly resemble the same in the sire than in the dam.

It is frequently remarked that the progeny of the first cross shows less of improvement than was shown by their parents. It could not be otherwise. When the parents were mated, it would be correct to say that the difference between them in blood elements would be represented by 100. At the mating of the progeny of the first cross that difference would be represented by only 25. There is not the same room for effecting improvement, and it grows less with every succeeding cross. On the basis of form, the following figures arbitrarily assumed will, it is believed, approximate the changes in the successive crosses: —

| CROSS. | Elements of Inheritance from Sire. | Difference in Blood Elements, 100. | Elements of Transmission remaining with Dam. |
|---|---|---|---|
| First cross, . . . . | 75 | – | 25 |
| Second cross, . . . . | 15 | – | 10 |
| Third cross, . . . . | 7 | – | 3 |
| Fourth cross, . . . . | 2 | – | 1 |
| | 99 | – | 1 |

This means that in regard to form and color the animals of the fourth cross would bear a close resemblance to the breed from which the sires had been chosen; in fact, in many instances the resemblance would be so close that an expert could not distinguish between grades and pure breeds. Thus quickly can change be effected in form. Four to five generations of such breeding will thus obliterate the blood elements of inheritance that at the outset pertained to the dams.

The first mating in the case supposed brought to the progeny an inheritance of 75 per cent of Holstein blood, and in the mating of the animals of the second cross an inheritance of 90 per cent of the same. Now, suppose that the second cross had been made with a Jersey sire. The inheritance of Holstein blood would have been cut down about 37½ per cent, and a new element, the Jersey blood, would have to be reckoned with. Those, therefore, who are continually changing the breed of the sire are like the mariner who sails without a compass.

But it may be asked, Are there no instances in which it would be advantageous to use a sire of another breed? Such instances may arise, but when they do the breeder has a specific purpose in view, and having introduced the outcross, so to speak, he goes back again to his old line of breeding. For instance, a dairyman may have in his herd high-grade Jerseys. They may be too small in size and delicate in form to suit his fancy. He introduces a brown Swiss sire, and then goes back to the use of Jersey sires. I am not to be understood as indorsing the frequent recourse to such crossing, but simply as showing that there may be a place for it.

To the kind of upgrading advocated above it has been objected that, while the first cross brings improvement, the second cross will show retrogression, at least in many instances. That is not true, except in the case of animals practically pure in breeding. It is the outcome to some extent at least of a conflict of potency in the blood elements, out of which come tendencies to reversion. Where the blood elements are much mixed on one side and are strong and unadulterated on the other, no such conflict can exist. Where the feeding and management are good, there should be improvement with each succeeding cross until that point is reached when the progeny will in appearance be the equal of the animals of the breed from which the sires have been chosen.

But will the improvement be as great, it may be asked, in milk production as in form under such a system of upgrading? I answer, No. How much less will it be? I cannot tell. I think the statement safe that claims a longer time to make change through transmission in function than through transmission in form. Thus it is that increase in milk-giving capacity will not be equal to the change made in form; and thus it is that a much longer time is called for to change the character of the wool fibers in sheep than to change the form that bears them.

## The Management of Dairy Cattle.

It would not be possible, in a paper such as this, to go over the whole ground of management. To do so would require a volume. I shall only attempt to dwell upon what seems to me to be the weakest spots in the system, and which, because they are weak, should be sedulously avoided. These include: (1) the sacrifice of cows on the block that would return a handsome profit in the dairy for years to come; (2) the loss of stamina resulting from improper methods of management; (3) the great hazard incurred by those who from time to time replenish their herds from outside sources.

## The Sacrifice of Cows.

This sacrifice is of course greatest among those who may be termed city dairymen, many of whom buy their cows and feed, and at the end of the period of lactation send them to the block. This accounts in part at least for the relatively slow increase of cows in this country. Many of the cows thus sacrificed have not yet reached the zenith of their usefulness. The number of cows in the United States at the beginning of 1907 was 20,968,265; and at the beginning of 1897, ten years previously, it was 15,941,767. The increase in the ten years was less than 32 per cent. Allowing for the necessary culling of poor milkers, the increase in the time limit named should have been several times 32 per cent. There would seem to be no good reasons why the number of cows kept should not be doubled say every five years, where this may be desired. Those city dairies are great maelstroms, which are forever drawing in good cows to premature slaughter. Nor does there seem any way out of the difficulty until those so engaged find that it will pay them to board extra good cows for six to eight weeks before lactation without getting any return.

But some who are not city dairymen make the same mistake. They feed high, and get a direct return for everything they feed. They chafe under the weeks of waiting for the renewal of the lactation period; hence even in these dairies many a good cow is sent to the shambles, that, if retained, would be useful for years in the dairy. Professionals at the business are continually scouring the country for cows that are soon to freshen; hence the temptation is strong to buy one of these to replace the cow that has but recently become dry.

In another way the sacrifice of good material for cows is very great. It occurs in the States that border on the western ranges or are not distant from them. Female calves in the neighborhood of one year old are purchased in great numbers and shipped out to the free-range pastures; in two years they are shipped eastward to be finished for beef. Many of those heifers would make excellent cows, while but few of them make beef of the quality that is most sought for.

### Loss of Stamina.

All are agreed as to the great value of stamina in dairy cattle. It is the power that drives the machinery resulting in production. Stamina has been lost in dairy cattle: (1) by requiring lactation at too early a period; (2) by forcing lactation unduly; (3) by adhering too closely to extreme dairy form; and (4) by too close confinement.

More commonly dairymen bring their heifers into lactation at the age of twenty-four months. The object is to encourage a bias in the system toward milk-giving. So far that object is good. But in reaching out for it, harm may result in certain directions. The young heifer has not yet completed her growth. As soon as she becomes pregnant some of the food fed is diverted from the heifer to the sustenance of the fœtus. This means that under normal conditions the heifer that produces a calf at twenty-four months will be of less size at thirty months than the heifer which produced her first calf at thirty months. That lack of robustness characterizes the progeny more or less, in the minds of dairymen, is evidenced in the fact that they do not care to rear such progeny for replenishing the dairy. The extent to which early lactation has been required has unquestionably militated against size in some breeds. The contention that nature points toward early breeding, since animals are capable of breeding at a younger age, loses its force when it is remembered that this is only true of animals reared under artificial conditions.

The undue forcing of lactation has been a sore evil in many a dairy otherwise well managed. It can occur only under liberal feeding, and under liberal feeding of grain. The story of all cows subjected to long periods of forced testing has been virtually the same. After a time the cow becomes less capable of producing; her progeny is lacking in vigor, and the entire period of her possible usefulness is greatly lessened. Similar results follow, though less in degree, with cows that may not be on test, but are fed heavily on grain.

The keeper of dairy cattle has on his hands a complicated problem. He has to face such questions as the following: How much grain may I feed without making the ration too costly? How much may I feed without injuring vigor in my cattle? Will it pay me to force maximum production all the time, or should I be content with less of production, and seek to make up for the loss in the lengthening of the period of usefulness in the animals? These questions will be easily answered by those who have ample field roots or silage on hand, but not so easily by those who have neither.

It is impossible, of course, to lay down any hard-and-fast rules that shall fix the amounts of meal that should or may be fed with advantage. The qualifying factors are many. The time of the lactation has an influence. The same is true of the power of digestion in the cow, the nature of the fodders fed and the quality and kind of the succulence given. The advice, however, which says that cows should be fed meal practically up to the limit of their consuming power is wrong. No cow can stand up against such feeding for a long time without injury, and such feeding is expensive. Ten pounds of meal per animal per day should seldom be exceeded, and in more instances 8 pounds should be the outside limit. With really good clover or alfafa hay 6 pounds per day would usually be enough. The meal is the expensive ration, and the aim should be to keep it as low in quantity as is compatible with fair results.

That the relation between dairy form and function is of the most close and intimate character cannot be gainsaid. In judging, therefore, of dairy function, dairy form cannot be ignored. But it is possible to carry the idea of dairy form to an extreme. It is so used, (1) when it is taken as an exact measure of dairy function, and (2) when it is sought to the extent of inducing delicacy in the animals which possess it.

When it is said that dairy form as usually recognized is not an exact measure of dairy function, the intent of the statement is as follows: (1) that dairy form will not enable the judge to determine which of two dairy cows is actually the better producer; (2) that cows not of extreme dairy form are in some instances superior as producers to those which are, though of the same breed and in the same herd, having also been bred on similar lines; and (3) because of such facts, the conclusion is irresistible that other factors have an important influence on function as well as form. Place two cows before the best judge in the country, and ask him to tell which cow is the larger producer. The cows have been bred in the same way, and they are very similar in form. If the judge is honest, he will say that he cannot tell. If asked wherein consists the value of form as an indicator of function, the answer is that it is safe to follow form as a general guide.

The dairy form carries along with it large capacity of barrel; refinement of head, neck and limbs; sharpness and prominence at the fore spinal column; and leanness and spareness generally. Now, all these can be sought in a marked degree without harm to the constitution, if one point is guarded, — that point relates to width of chest. The width of chest may be pretty well determined by observing the distance between the forelegs. When these have little space between them, and more especially in the males, they are coming toward the danger point in narrowness of chest. The stamina of the animal must be guarded, or soon dairy function will suffer.

That the stamina of dairy cows has been lowered in many instances cannot be denied. That such lowering of stamina has extended to whole herds in some instances is painfully evident. The evidences are found in the alarming prevalence of tuberculosis among dairy cattle, in the difficulty found in rearing calves in many dairy herds, and the increasing percentage of the losses in the herds. That these facts have been forced home upon dairymen, or at least some of them, is seen in the outcrosses which have been introduced into high-grade herds from some more rugged breed.

This problem is one of the most difficult that the dairyman has to deal with. He has found by experience that when his cows are out much of the time in the winter, even in a sunny and protected yard, they give less milk than when not so exposed. Because of this, the temptation is strong to give them but little exercise, especially in cold weather. The high-pressure feeding goes on, and as a result it may be that serious trouble is found in rearing the calves. What is the dairyman to do? He can follow one of two courses, or he can combine the two. The first is, as is well known to dairymen, the erection of an enclosed shed near the stable, in which the cows are fed in the day; and the second is to give them more exercise in the yard in reasonably good weather than is usual. In the shed they run loose. It should of course be well ventilated, and have windows that will admit abundant sunlight on the sunny side. To give the cows ample exercise in the yards, are there not instances in which this would pay, even at the sacrifice of something in the milk yields?

## Replenishing Dairy Herds.

In the judgment of the writer, the dairyman who proposes to make dairying his principal work should aim to breed his own cattle. If he does not, he incurs the risk of introducing disease that for a time at least will take away all profit and that will make life a burden for the time being. The two forms of disease that are proving specially harmful are tuberculosis and contagious abortion. Each of these has in many instances proved a veritable scourge where it has been introduced into herds into which it could not have come had no animals been introduced from outside sources.

The method followed by some dairymen with reference to tuberculosis is unaccountably short-sighted. They have in some instances had their herds tested. Some animals in the herd have reacted. These have been removed, and the gap thus made filled with untested cows from an outside source. Some of the cows thus brought in may have been tuberculous. The dairyman may have been compelled in these instances to purchase cows to enable him to keep faith with those who take the products of his dairy. Even so, why were these cows not bought subject to test?

There is but one safe way to rid an infected herd of tuberculosis and to keep it clean. The herd must be tested by a competent person. If tuberculous animals are found, they must be removed, but not necessarily for purposes of immediate slaughter. The herd should be again tested six months later, and two tests should also be made the following year, after which one test a year should be made until the trouble disappears. To allow trading in cows brought in from outside sources, in the absence of the tuberculin test, is simply vicious. No man who breeds cattle can afford to ignore the presence of tuberculosis in his herd. Just as surely as he does, so surely will tuberculosis exact from him a severe penalty.

Contagious abortion in a breeding herd of dairy cows is destructive of all profit and all progress. This most elusive disease, like the pestilence, walks in darkness. It would not be correct to say that when it invades a herd treatment is of no avail; but it is correct to say that treatment seldom succeeds in removing it short of two or three seasons. Happily, it is a disease that cannot come to a herd unless it is in some way brought; hence the dairyman who breeds his own stock and who is judicious in the selection of males need not fear contagious abortion.

To the writer it does seem unfortunate that so large a proportion of those who are engaged in dairying do not breed their own cattle. As long as the cows milked are drawn from outside sources, just so long will it be practically impossible to keep them entirely free from disease. The good old-fashioned way of breeding on the farm the stock wanted there has many things to commend it. Could this plan of providing stock become almost universal again, there would not be much use for live stock sanitary boards in the various States.

## The Labor Problem.

The labor question bears heavily on dairying at the present time. The care of dairy cattle is like the story in the fable, — it is without an end. Such close attention is irksome to the average young man of to-day, and it may be added possibly more so to the average young woman. But, says one, you would not have women care for dairy cattle. I answer that I would have girls and matrons milk in well-ordered dairies, unless special reasons can be given why they should not. It is argued to-day that milking is not suitable work for refined woman, as found in the average farm home; and that she has ample work in the duties of the home, if these are properly discharged. There is a measure of truth in both contentions, under some conditions, especially in that given last. To the writer the work would seem only unsuitable as such when the stables are not properly kept. If unsuitable to the average farm matron of to-day and to her daughters, then a rank injustice was perpetrated on the women of a departing generation in allowing them to aid in milking the cows. It was that departing generation who gave to this nation very many of its builders. They came from homes where the mother could help in the milking if it were necessary for her to do so. The sisters of those men could milk when they were girls. Will the girls of to-day who have unfurled the banner of rebellion against milking in the average farm home do more for the nation than that grand army of women now fast vanishing, who did not think it was undignified to know how to milk? I would not be misunderstood. I am not urging the relegating of the milking to the women of our farm homes. Let the men do it where such help is obtainable; when it is not, let a helping hand be given by the women of the home.

## The Great Future for Dairying.

It is questionable if the time will ever come when the demand for good dairy products will not be brisk. The amount of labor which it entails hinders many from engaging in it who would otherwise take up the work; it is therefore one of those lines of production that is not likely to be overdone. Never before in the history of the world has there been so great a demand for milk as an article of food, and that demand is growing. No other kind of production takes so little from the soil. Because of this and because of the extent to which concentrates are fed to cows in milk, dairying brings with it increasing producing power to the land. No other form of animal life will furnish food nutrients more cheaply or better adapted to the needs of the average individual of the race. The path of intelligent dairying is strewn with beneficence. Every one, therefore, engaged in dairying can well afford to magnify his calling.

QUESTION. What breed would you prefer?

Professor SHAW. I would answer that question differently in almost every State in the United States. I would say for this State that the man engaged in dairying, if dairying is his main and principal business, should have a straight dairy cow; no matter which of the breeds, it should be a straight dairy cow. They are produced by weeding out every one that doesn't come up to the standard; and you will never come to the end of this weeding business, for it will always be, — there are good and bad cows in all breeds.

QUESTION. Should the sire in this sort of breeding ever be mated with his offspring?

Professor SHAW. That is legitimate sometimes. As long as the animals are possessed of a marked degree of vigor, that is allowed. But it is something that must be done with great care, or inferiority will be transmitted.

QUESTION. Don't you think some breeds are stronger than others, and predominate in the crosses? I used the Holstein blood, and since they have been crossed by the Jersey the Holstein is the stronger.

Professor SHAW. That is just a question, — it is a question to be disputed. We mustn't lose sight of this fact, — that we cannot always judge the amount of transmission from the color; that is only one way. There is transmission in other respects that is very marked, but not so apparent to the eye.

QUESTION. If you were breeding cows for milk, that were giving you 30 to 40 pounds of milk a day, and you wanted to raise their progeny, how often would you have them freshen?

Professor SHAW. I would try to have those cows freshen every year, not beginning too early. If you could be assured that they would breed regularly every fifteen months, instead of every twelve months, that would be so much better for the progeny; I am satisfied of that. I think a straight dairy cow should produce her first calf at about thirty months, but not younger; a grade cow, older than that.

QUESTION. If you had a good type of grade dairy cow, and she had been milking eleven or twelve months and was still giving 8 or 9 pounds of milk a day, would you make any effort to dry her off, so as to bring her around again?

Professor SHAW. No; I don't think I would until I was sure that she was going to freshen.

Mr. BURTON W. POTTER (of Worcester). Mr. H. W. Mowry of Syracuse, N. Y., said a few years ago that he had a man who took more interest in the sires than in the cows, and took better care of them, and as a result he had more male calves. He changed his foreman to one who took a greater interest in the cows than he did in the sires, and took better care of them, and the next year he had many more heifers than male calves. That was a case of actual practice on the farm.

The professor says the reason there aren't more lectures on breeding is because it is so difficult a question to handle. That may be true, but I think another reason is, that we have got out of the idea of thinking about it. Dairymen and milk producers have gone out of the State to buy their cows, and the art of raising cows has become a lost art, in a certain sense. I know of dairymen or milk producers in Worcester, and I presume it is safe to say in other places in the State, who never have a calf born on their estate. They take care of the cows, and feed them high, force them high, and keep them as long as they give a profitable amount of milk, and then they are sent off, so they never have a calf on the premises.

I think the professor has rather belittled the value of race inheritance. Take it in the human race, for instance; we have an idea that the race qualities are very dominant and powerful. Take the Irish race, for instance, and the Jews; take the Anglo-Saxon; and we find the distinctive qualities are handed down not only from one generation to another but one century to another. We frequently find that animals will take back. For instance, I have Holsteins, and once in a while we will have a pure-blooded red-and-white calf. Why is that? It is because the ancestors of those cattle were raised in Holland, and they take back, and take on the distinctive color of those animals of perhaps one hundred or two hundred years ago. It seems to me the question of race inheritance does cut some figure in breeding.

I think the professor in his talk about the prepotency of the sire and dam has illustrated it very easily on the blackboard, but is it always so easily done? My experience is that the old cow is about as important in raising a calf as the sire is. I never have known of having a good calf that made a good cow unless she was out of a good dam.

Professor Shaw. Pardon me for speaking here, but I wish to make it plain. You speak about the dam having a great influence on the progeny, as well as the sire, — that old cow of good quality; but you don't get aside from the fact that she inherited those good qualities for a good long time.

Mr. Potter. Most of the great men in history inherited their greatness from the mother as much as from the father; and I think that is true with cows, — that, if a cow has good qualities and is strong, she may be more prepotent than the sire. It doesn't always follow that because an animal is pure blooded he is prepotent or remarkably good. There is such a thing as a pure-blooded scrub animal, and if you have one of those, and mate it with a dam that is a good producing animal, you are just as likely to eliminate on one side as the other. You are liable to be mistaken when you say you can breed out all the qualities of the scrub in three or four generations.

Professor Shaw. I will just give an instance, if you will pardon me, from my own experience, — not with cattle, but with sheep. The principle is the same, although the time required may not be quite the same. I went to the stock yards at St. Paul and bought the commonest kind of ewes I could get. From their appearance they bore more Merino blood than anything else, but I know they had four or five different bloods mixed up in their combination. I took those dams home and had them mated with a first-class, prepotent Southdown sire. The lambs of the second generation were sent to Chicago to the international fair, where they were shown against the world, and they won first class.

Mr. S. H. Reed (of West Brookfield). The late President Stockbridge of the Massachusetts Agricultural College gave me a rule a good many years ago for controlling sex, which I never forgot. He said every farmer has a practical test in that line when he turns out young cattle. Suppose he turns out a young male between one and two years of age, usually all the first calves that appear will be mixed, may be half males and half females; but later in the season, as those cattle begin to thrive, they will nearly all be males. That accords with my experience. Also, if I have a young animal in my herd that is not very well fed, nature will seek to balance between the male and female, and there will be more males. If the cows are in good milking shape, and the male is about two years of age and well kept, so he has the run of the cows, then there will be a large predominance of females. That is my experience, and the experience of a great many stock raisers I know of. The principle is, that nature seeks to equalize between males and females.

I think Mr. Potter is right in what he says of the influence of the cow; and we can see in the human family that the boys resemble their mothers and the girls their fathers; and we can distinctly recognize in the cow that she has a greater influence over the males and that the sire has over the females in a good many respects. I believe that the cow influences the quantity of the milk and the male the quality of the milk, speaking in general terms.

Mr. P. M. Harwood (of Barre). I believe if you have followed the lecturer closely, you will have seen just what he meant in what he said. He said that like producing like is the dominant law. That is true; but the variations to that law are so strong that it might lead many people to think that they were equal to or greater in strength than the dominant law. You might take a cow that was giving a very large amount of milk. The chances are that the daughters from that cow never will equal the dam. Why? Because of the variation which has developed her from the normal — the abnormal condition to which that cow has come so that she can produce that enormous amount of milk. She has "shot her bolt," to use the expression, and she can't produce a calf that will equal her. It is an impossibility.

A natural born stock breeder is essential to success, I believe. You can train men in some lines; you can train a stock breeder so he will improve, but he must have a love for his business and he must have the natural ability to see things which, perhaps, to the average man, or to many at least, are not visible at all.

I want to say just a word on the matter of vigor. The dairy cow to do her best ought not to travel over many acres of land, but she needs to have access to plenty of good air and sunlight, and should have a *limited* amount of exercise.

There is one thought that occurs to me, which I think is of importance to breeders of pure animals, and that is, the fallacy of laying too much stress upon color. It was my fortune, or misfortune, a short time since to recommend a certain Guernsey sire to a Guernsey breeder in this Commonwealth. I didn't know that the man was going to buy it, but he asked me if I knew where there was one, and I described one that I recommended very highly, that had individual merit, — the rich color of his skin, and his hoofs and horns; and his ancestry was all right. A few months ago this man came to me, and he said, "There have some brown hairs appeared in the face of that bull." Now, that is something that is cropping out constantly among the Guernseys, to take them for an illustration. Of course the Guernsey breeders don't like that, and want to breed away from it; and if you have any experience in breeding, you will see what a tremendous cost to the usefulness of the breed must come with this elimination of the animals that present some few hairs or color that is not endorsed by the Breeders' Association. I think the time is not far distant when things of that sort will be wiped out; I think they will have to be, in the interest of success among breeders.

Mr. Geo. H. Ellis (of West Newton). I came here to learn, and want to get the benefit of the experience of others; but taking the address in the main, it is a mighty good thing for us to take home and follow. Now, this question of percentages, as I understand Professor Shaw, he has simply adopted these figures as something indicating what you might expect. They are not in any sense arbitrary, but the direction in which they lead is unquestionably correct. I should not agree, to begin with, with his proposition, if I were talking with some one here who wanted to begin grading up his herd, that it would be as well for him to take a scrub cow with all the mixed breeding that he could possibly find. I should think that, if he wanted to breed for larger production, and were to take the Holstein sire, he could pretty nearly eliminate one generation, because he should then look for his dams too, because they have been bred something along that line. He would then eliminate this one year. When he comes to his second generation, — as I understand Professor Shaw, he does not advocate inbreeding to the extent of breeding sire to dam except under rare circumstances; he then has got to take a second sire for his second generation; and if he were to begin to-day to breed, let him begin, if he can, with dams that have already taken that one year, and save one generation. Take cows that are themselves good producers. But if he is going to breed Holstein, take a cow that is 50 per cent Holstein, and it is comparatively easy for him to do that, and not take the simple grade scrub cow that seems to have no breeding whatever. I think he would gain something in time, and time to that man who is undertaking to breed his herd up is money.

Another point, that of exercise, I am a thorough believer in. While temporarily a farmer and producer will secure a larger amount of milk from his herd if he keeps them in close quarters, keeps them very warm, and gives them warm water to drink, and doesn't turn them out to exercise, I have little doubt that he can secure for a season a larger amount of milk, and for the dairyman who is simply making milk for the market, and buying his cows, that may be a wise proposition; but as Professor Shaw has been speaking to those of us who are not only making milk, but also doing our own breeding, I do not believe that is a wise thing, nor do I believe it is wise even under the conditions of the farmer who is producing milk for the market, if he is intending, as a good many do, to sell the cow after one year's service. It won't make very much difference, but for one I would prefer to use the milk from animals who have a reasonable amount of exercise and a large amount of air, even if they don't look quite so slick and smooth and don't give quite so much milk. I think in the long run we would be the gainers by it.

In the matter of transmission, spoken of by one or two, and particularly by Mr. Harwood, — in regard to the fact that your very large producers seldom transmit it to their offspring, and, as he has stated, these producers are supreme producers under forced conditions, — what we are to consider is the question of transmission from exceptionally good animals, who have not been forced, but have been carried along under normal conditions. In such cases I believe we can look for the transmission of those qualities, frequently magnified, extended in the following generation. If, in the case of the trotting horse cited, that horse is driven to the utmost capacity, I do not believe, as does Mr. Reed, that you are likely to produce just as good and better animals than themselves. I believe it has been taken out of them on the race track or in the milk pail. You cannot expect, even with a vacation, that they will recuperate and will give you nearly the same individuals they would have given you under normal conditions.

And I am a firm believer in the doctrine of prepotency. I have owned a good many bulls, first and last. The first one I ever did own was a pure-bred Jersey, who was so prepotent that to-day — and his work has been done for several years — to-day you can almost trace the progeny of that bull in general characteristics, and the character of the milk pail, and the butter fat. The prepotency was there to an extent that I have never seen it elsewhere.

Professor Shaw. Perhaps I didn't guard quite as much as I should have done that question beginning with what I term scrub foundation. It is perfectly true that, with a cow whose milking qualities were pretty well developed, the improvement will be more quickly made than with the kind of cow that I talked about. That is certainly correct, because the dairyman who is seeking that kind of improvement is seeking an improvement in milk-giving, and if he begins with a good milk-giving cow he is going to get there more quickly than if he begins with one that is not a good milk-giver.

Question. But wouldn't that more likely be true if these cows have extra milking quality from lines along those which you are using?

Professor Shaw. That would certainly be true; but the point I want to emphasize is this: ask the average farmer, who has common cattle, to go to work and improve his cattle, and if you can persuade that man that by buying a good sire and using it on his cows in a few generations he may effect the desired improvement, he may do it; if you tell that man he has got to do away with those cows and then buy his sires, he is not going to do it. Now, it is the man who is going to do it that I am after.

Adjourned at 12.20 p.m.

## Afternoon Session.

The afternoon session was called to order at 2 o'clock by Secretary Ellsworth, who introduced Mr. C. D. Richardson of West Brookfield as the presiding officer.

The Chair. It is my pleasure to preside this afternoon, when I expect the matter of the milk product and the marketing of the same will be definitely settled. The speaker is Mr. C. B. Lane, assistant chief of the Dairy Division of the United States Bureau of Animal Industry, who kindly substitutes for Mr. B. D. White of the same Bureau, who was unavoidably prevented from keeping his engagement to be with us. Mr. Lane will speak on "Market milk," and will illustrate his lecture by the photographs and tables on the wall.

# MARKET MILK, FROM PRESENT-DAY STANDPOINT.

BY MR. C. B. LANE, WASHINGTON, D. C.

There is scarcely a subject that is of interest and importance to so large a number of people as market milk. The five million or more dairymen who keep cows are of course interested, as they are dependent upon the production of milk for their livelihood. Almost every family in the land is interested, for the reason that they consume milk in some form every day. There is no more wholesome food for old or young than the product from the cow. The nutrients contained in it can be purchased at about one-third the cost that they can be obtained in beef, and they are almost entirely digested. The dairy cow gives us the most animal food at the least cost, and I might say further that the dairy cow is the only animal that will return a good profit on high-priced land. This is well illustrated on the islands of Jersey and Guernsey, where land is worth $400 to $500 an acre, and where the dairy cow is making the farmer rich. The same is true in Denmark and Holland.

I have said that the dairy farmer and the public are interested in market milk. Now, unfortunately, there seems to be a general impression that the interests of the farmer and of the public are diametrically opposed, — an impression which I believe has little basis in fact. The farmer wants a good demand and a good price for his milk; and I believe that it has been shown, particularly during the past few months, that the more intelligent public is beginning to want clean, pure milk, and that it is willing to pay more where the increase is shown to be reasonable and necessary. There is something radically wrong with the relation between the milk producer and the milk consumer in this country to-day. The demand for milk is far less than it should be (about three-fourths of a pint per capita). I believe one reason for this is the lack of perfect confidence between the producer, the consumer and the medical profession. If this confidence were established, the demand for tinned milk, condensed milk and milk substitutes in various forms would decrease, and fresh milk take their places. If, therefore, I can say anything here to-day that will tend to restore this confidence, which is so important to the dairy farmer, I shall feel well paid for coming here.

### The Producer's Responsibility.

The public is beginning to feel that the producer has been a little too careless and indifferent as to the conditions under which milk has been produced and handled. The question of cleanliness, then, from the standpoint of the producer is no longer a matter of sentiment, but a practical business proposition. As soon as the public has confidence in the producer, and knows his products are produced under clean and sanitary surroundings, there will be more milk, butter and cheese consumed than there is to-day. Milk is naturally a pure product, and if found unclean or unwholesome or unnatural in composition, the chances are it is not the fault of the cow. Some one is to blame. It may be the producer, it may be the middle man, or it may be the consumer; but sometimes we know it is the producer. When we see large amounts of dirt in the milk, it is probably the producer's fault. What would you think of finding a teaspoonful of dirt in the bottom of the milk bottle on your table? Yet this is not uncommon. [Illustrated by two charts.] Such milk is dangerous and disgusting. We probably consume more filth in milk than in any other food. We cannot afford, as dairymen, to let the consumer get the idea that milk is produced under dirty conditions. We must admit that our dairies are not up to a reasonable condition of cleanliness. Out of a thousand dairies around Washington, scored on the basis of a score card, 100 per cent being perfect, the average score was only 45. Of the first 5,000 dairies inspected by the New York City board of health, just 5,000 were asked to clean up and make improvements before they were allowed to continue to sell.

I am aware that you are making great strides in improving your conditions. As I have said before, this is strictly a business proposition. What shall wo do about it? We will assume, first, that the health authorities are not going to ask anything unreasonable, and are going to insist only upon those things which are entirely practical and sensible; that the dairyman will be protected from unfair prosecution; and that dirty milk shall not be allowed to come into competition with clean milk. With these conditions, I believe that every intelligent dairyman should fall into this line of progress, and welcome inspection, and say to the health officials, We are ready to do our part, if you will do yours. What the dairymen should not do is to get together and hold indignation meetings, and condemn those who are doing their duty, besides working against their own best interests. It is true that some of us will have to change our views a little bit; and it may be hard for us at first to see why conditions and methods which have been approved for the last twenty-five or thirty years are now condemned. We will have to realize more fully that it is a food product which is being prepared in the cow stable, and that the surroundings should be as clean as the place where the bread is made or the potatoes peeled. Our standards for clean milk to-day are not the same as they were forty years ago. With increased knowledge of bacteriology and of the dangers of impure milk our ideals have changed, and the dairyman must advance and keep pace with progress along these lines. He should be in a receptive mood. While he should secure as high a price as possible, even at the present prices for feed and labor milk production is a profitable business, if cows are properly handled, fed and housed. I do not know of an instance where this does not hold true. This does not mean expensive quarters, but comfortable quarters, stables well bedded, lighted and ventilated, with comfortable ties.

The fact should not be overlooked, however, that feeds and labor have greatly increased during the past few years.

Thornton says it costs twice as much to keep a cow to-day as it did ten years ago; and if milk kept pace in price with the feed that goes with it, a fair price to-day would be 16 cents per quart.

Now, let us, as practical dairymen, see if we cannot agree as to reasonable requirements in the production of milk. You as producers should be interested in this; the consumer wants clean milk, and it is for your best interests to produce it in an entirely satisfactory manner, and to be known as dairymen who produce clean milk.

We will go over the points briefly: —

*Cows.* — You will agree with me that the cows should be clean, — that is, free from dirt and filth; that the cows should be healthy; that no other animals should be allowed in the same stable; and that the water supply should be clean and fresh, and not exposed to contamination.

*Stables.* — That the stable should have a tight, sound floor (the plank floor is not durable as commonly laid, and allows liquids to leach through, making a decidedly unsanitary condition; the cement floor with plenty of bedding is the best); that dust-catching ledges, partitions and unnecessary woodwork be done away with, as far as possible; that the stable should be free from cobwebs and manure (outside of the gutter), and dirt or filth of any kind; that the air should be free from dust or objectionable odors; that whitewash is a very inexpensive and effective agent of sanitation, and should be used twice a year; that sunlight doesn't cost anything, and we should give the cows plenty of it, and that 4 square feet of glass to each cow is not too much; that some effective ventilating system be provided, that each cow have at least 500 cubic feet of space; that the manure be removed to the field daily, or at least far enough from the stable to prevent contamination; and that the stable yard be drained and in good sanitary condition.

*Milk Room.* — That a milk room be provided, which shall have a tight, sound floor; that it be reasonably well lighted and ventilated, and that preferably it be separate from other buildings, except possibly the ice house; that it be equipped with hot water for cleaning utensils and sterilizing the same, a milk cooler, wash tanks and proper utensils, used for no other purpose; that the room be clean and free from flies; that the utensils be placed upside down in suitable outside racks; and that the water supply for washing utensils be pure and clean, and free from danger of contamination.

*Milking.* — That the cows' udders and surrounding parts be wiped with a clean, damp cloth before milking; that the milkers wear clean clothes, and milk with clean, dry hands into a small-top milk pail; and that the milk be removed from the stable and properly strained after milking each cow.

*Handling the Milk.* — That the milk be cooled promptly after milking, to a temperature of 50° F. or below, stored in a proper place at a similar temperature and protected in transportation.

*Temperature during Experiments 40° F. (Park).*

| | Number of Bacteria in the Fresh Milk. | Number of Bacteria after Twenty-four Hours. | Number of Bacteria after Forty-eight Hours. |
|---|---|---|---|
| Sample *a*, . . . | 2,400 | 2,500 | 3,600 |
| Sample *b*, . . . | 30,000 | 38,000 | 56,000 |

*Temperature during Experiments 50° F.*

| | | | |
|---|---|---|---|
| Sample *a*, . . . | 2,400 | 11,600 | 540,000 |
| Sample *b*, . . . | 30,000 | 89,000 | 1,940,000 |

*Temperature during Experiments 70° F.*

| | | | |
|---|---|---|---|
| Sample *a*, . . . | 2,400 | 450,000 | 25,000,000,000 |
| Sample *b*, . . . | 30,000 | 4,000,000 | 25,000,000.000 |

### The Health Officer's Responsibility.

Laws must always be in force for the wilful law breaker, the careless and the ignorant; and the public should have a right to protect itself from disease or an impure product. Some of our city health departments have perhaps been a little too radical, and have not always met the producer half way. The health officer should have patience, and should endeavor to point out to the dairyman his faults, and give him a fair chance to improve before condemning him. Co-operating is a good deal better than clubbing. Of course it is understood that the persistently dirty dairyman must be dealt with with a firm hand; but the point that I want to emphasize is, that the majority of dairymen are not wilfully dirty, and that they are willing to do anything reasonable; but they need to be condemned less, and assisted and encouraged and instructed more. If the inspector could be looked upon as an instructor, rather than as an official inspector on police duty, many of the difficulties between health boards and dairymen would disappear. Such instructions should be given right at the dairy farm, with the dairyman on the spot, and it should be given by capable and practical men. The dairyman has often had good reason for objecting to inspection. For example, an inspection force was appointed in a western city recently, which consisted of an engineer, a detective, a solicitor, a machinist and an ex-policeman, — a good example of what politics is doing for a number of our cities. We have colleges and dairy schools for training men for this work, and if they are not doing it, they ought to; and if they are doing it, then there is no excuse for not securing such men for this work.

*The Score Card as an Aid to Inspection.* — The score-card system of rating dairies has been of much assistance in lessening friction between inspector and dairymen. Its advantages have been demonstrated in a large number of cities; and have proved helpful in the following ways: —

(1) In giving the dairies a definite, mathematical rating, which is much better than using general terms, as good, fair, bad, etc.

(2) In pointing out defects, and showing where improvements can be made and often at little expense.

(3) The system gives little opportunity for favoritism, as each branch of the dairy has a definite number of points assigned to it.

(4) The system encourages confidence among dairymen in

the inspection work, as they feel that they are all being treated alike.

(5) It encourages competition between dairymen for the best scores; as a result, they take more pride in their work.

(6) It aids the dealers in finding the better dairies and in grading the milk.

(7) It leads to greater profits; more attention is given to detail, and this is important to success in any business.

(8) It shows the consumer the rating of the dairy supplying him with milk, and gives him an opportunity to patronize the better dairies.

(9) It furnishes boards of health an excellent system for keeping records of the condition of dairies and milk plants, and in following the work of inspectors.

Some of these advantages are well illustrated in a report of the health officer of Montclair, N. J., in which he publishes, for the benefit of producer, dealer and consumer, the average year's rating of every dairy supplying the town with milk, and in addition to this the average content of fat and solids in the milk and the bacterial count of each dairy. This, to my mind, is approaching the ideal in milk inspection and control. As a result of this plan of procedure, the better dairies receive the best prices for their milk, and the dirty dairies have to accept a cent or two per quart less. This is as it should be. High prices for a high-grade product, and any dairyman may enter the highest rank just as soon as he is willing to spend the time and money necessary to put him there.

*A Promising Outlook.* — I have seen many things to convince me that if the dairyman is approached by the inspector from the standpoint of giving assistance and encouragement, rather than in an antagonistic way, he will treat the inspector right, and often thank him for his visit.

The following letters will give an idea of the way this work appeals to the dairy farmer, and indicate what may be accomplished by the score-card system along the line of improvement of milk: —

DEAR SIR: — It gives me great pleasure to meet your dairy inspector. He called at our farm and thoroughly scored our dairy, giving us 75 per cent, and showing or pointing out to us where we might score 100 per cent with a few improvements; this fact we appreciate very much. I am just writing these few lines to show our appreciation of the valuable work that you are accomplishing for the benefit of the public health, as well as the welfare of the dairyman at large. The visit of the inspector did me a world of good, pointing out our defects in the dairy.

Wishing your department the hearty co-operation of all the dairymen, I am Yours sincerely,

(Signed) *Manager for* —— ——.

MY DEAR SIR: — I want to thank you personally for your visit to our farm this week. It has inspired me with renewed life and vigor. I shall not wait until the new year to make new resolves and promises, but begin right now. I know I shall never reach my own ideals, even, but I have made up my mind to try. No matter what the motive is of the Department of Agriculture in sending out such inspectors, it cannot fail, in my judgment, to do immense good.

I want you to come around next year again, and if I am not entitled to be marked up at least 20 points, I will promise you to go out of the business, and I ought to.

Very truly yours,

(Signed) —— ——.

These letters, mind you, were not solicited, and are the free expression of the dairyman himself.

Again, in the city of Cleveland, O., after a dairy meeting and milk contest, eleven representative dairymen got together and wrote a letter to the board of health, as follows: —

We milk producers, who ship milk to the city of Cleveland, desiring to make and ship milk of good quality and to observe the sanitary regulations as prescribed by your honorable body, respectfully ask that each and every person shipping milk to the city of Cleveland be required to take out a permit, to be issued by your honorable body, revocable at your pleasure.

That said permits shall be classified as 1 or 2. That dairies which score 50 points or above be classified as No. 1, and all dairies which score below 50 points be classified as No. 2. That all milk dealers, shippers and peddlers who sell milk in the city of Cleveland be required to apprise their customers by placard or otherwise at all times of the class of milk that they are offering for sale; and in case of failure so to do, or in case of said milk dealer, shipper or peddler offering for sale milk shipped into the city of Cleveland without a permit, said milk dealer, shipper or peddler's license shall be forfeited.

Austin Herrick
W. A. Mills.
H. F. Bicker.
S. H. Mizer.
O. H. Bennett.
E. Bowen.
H. E. Post.
G. W. Adams.
W. H. Chambers.
A. F. Dresher.
C. E. Riley.

This clearly shows the attitude of dairymen toward an inspection system that is conducted fairly and honestly.

### The Consumer's Responsibility.

There is no small responsibility resting on the consumer. Milk is frequently delivered to him in good condition, but he does not take proper care of it. Too often it is exposed to the sun, and rapidly deteriorates. Frequently it is set away with other food, without any protection, where it absorbs any odors present. When the milk is received, it is the duty of the consumer to put it immediately in a cool place, away from strong-smelling foods. Milk bottles should be used by the customer for no other purpose than the storage of milk. It is also the duty of every person using bottled milk to clean the bottles before they are returned to the dealer, and to return them promptly.

The majority of consumers do not know what good milk is. The consumers need to be educated, for it is through them that this problem of clean milk will be eventually solved. If the consumer does not know what clean milk is and does not ask for it, and is satisfied to pay for dirty milk at dirty milk prices, then why should the dairyman produce it? What is the use in legislating and enforcing city ordinances for a product that the people do not want? The consumer should not be willing to pay as much for dirty milk as for clean milk. He should appreciate the fact that clean milk costs more. It costs only $9 per cow to produce milk any old way, and it costs $54 to produce clean milk.

I believe the time is soon coming in some of our cities when the health authorities, dairy farmers, milk dealers and consumers will all work together for a wholesome milk supply. Such a working arrangement is not impossible at the present time in some of our cities. To accomplish this, the dirty dairies will need to be brought up to a reasonable sanitary condition, the health authorities asking for nothing unreasonable. The dairyman should be protected from unfair prosecution, and from the competition of dirty milk, which now sells for the same price as clean milk in most instances. The interests of the public and the dairyman are one, and just as soon as they can be made to see this, many of the present difficulties in the clean-milk crusade will disappear. What most of us need is not more dairy knowledge, but a better application of that we already have.

Question. What is the best usage in regard to utensils, — in regard to the open pail? I understand some producers who produce an extra quality of milk, certified milk, use in preference an open pail, on account of milking into a covered pail through a strainer, and the inevitable spray which results and goes upon the hands and clothing of the milkers.

Mr. Lane. That is a good question. Some of the certified milk producers do use an open pail, but they always use a small-top milk pail. There are several very good types of those in the market. Some of the certified milk producers, it is true, don't use any strainer in the small-top pail. This pail is very often used open, but it only has a diameter of about 8 inches across the top; and if your dairy is clean, and your cows and pail and everything is clean, there is no particular advantage of having a strainer on the pail in the stable, because if there is no strainer the milker is a little more careful in milking, and if there is a strainer and any particle of dirt gets on it, of course it is washed right through just the same.

Mr. George Albee (of Concord). The intelligent farmers in Massachusetts are, I think, most of them, of the opinion that dirty milk should not be allowed to be sold at any price.

Mr. Lane. I think I have indicated this afternoon that the dairyman as a rule is coming to have the right view of this thing, and he simply wants to be treated fairly and squarely.

Mr. Albee. What, in your judgment, has a commercial standard to do with the question of purity of milk? We in Massachusetts consider the commercial standard that which has to do with the money value of milk.

Mr. Lane. Exactly; but a commercial standard may relate to the cleanliness of the milk, as, for example, a standard for bacteria; or it may relate to the chemical qualities, as, for example, the fat and solids; in either case it is a commercial standard.

Mr. Albee. As we understand it in Massachusetts, the question of the health standard has to do with the bacteria. What does the commercial standard have to do with the health qualities of milk?

Mr. Lane. A commercial standard for dirt or bacteria has a good deal to do with health.

Question. What is your opinion of the value of basement barns in which to keep dairy cows, as compared with barns not built on basement plans?

Mr. Lane. From a modern standpoint, of course, the basement barn is not considered as good as the barn that is not a basement barn; that is, if any one were going to build a stable in these days, he would hardly put the cows in the basement. If you could ventilate it and put light enough in it and make it comfortable, then there could be no just criticism of your basement barn.

Question. How about a manure cellar under a cow barn?

Mr. Lane. It ought not to be there, — it is a breeding place for flies; and I don't care how tight the floor is above, more or less odor is bound to come up to the stable.

Question. What do you think of a barn built on the basement plan, — I don't mean a basement barn sunk in a bank, but a barn in which the cows are kept in the lower story, and fodder stored above? I would call it a basement where the cows stand. How do you think that barn compares with a barn of one story?

Mr. Lane. That is a good question. It seems to be an opinion that storage over the cows is a bad thing, but it needn't necessarily be so; if the ceiling is tight over the cows, so no dust or dirt or hay can get down through, there is no objection to storing it over them.

Question. Take, for example, a stable with a proper, tight floor, with a basement for removing the manure to, — do you think you would get more dirt from that than with the modern barn, — with a drop, which perhaps will be put down four or five times a day, into a cold cellar, where the odor is stopped, where there is no fermentation?

Mr. Lane. Oh, yes; the modern barn is more sanitary. You have to consider the condition of that cellar the year round. It is difficult to keep it sanitary. You don't get any odors in the modern barn; if you do, there is something wrong. A barn cellar is a breeding place for flies, in the first place; and it is also too close to where the milking is done. The manure should be removed far enough from the stable to prevent any contamination.

Question. Is it now regarded that there is no reason for a difference between the summer and winter standards of total solids in milk?

Mr. Lane. You have asked for my opinion, and I am going to give it. I had charge of a herd of about 50 cows for seven years, and I analyzed the milk from that herd every week the first three years, and later on every two weeks, and I didn't find any great difference in the composition of the milk in that herd between summer and winter, or one month in the year and another; and it is my opinion that, if a herd is properly fed, — that is, fed a good balanced ration the year round, whether summer or winter, — there won't be very much difference. But if you have been feeding your cows a good ration all winter, and then turn them out on green rye or something of that sort in the spring, and don't supply them with a balanced ration, and don't give them any fine feed along with it, you may get a little drop. It is my opinion, if a cow is fed a balanced ration the year round, there will be scarcely any difference.

Question. Is it possible for a farmer here in New England to raise sufficient grain or raise all that is necessary to feed his cows on his own farm, so it wouldn't be necessary for him to purchase grain, and at the same time get a good flow of milk?

Mr. LANE. I believe it is possible, although you don't have as much chance as further south. In New Jersey we often fed a cow on a ration grown entirely on the farm. We fed alfalfa hay, cow pea hay, clover hay and protein foods of that character, combined with corn silage and corn meal grown on the farm, thus making a well-balanced ration. You might be able to do this in New England. You can certainly grow clover hay and corn. As a rule, however, it will pay best to buy some of the protein in the form of cotton-seed and linseed meal, or other feeds rich in protein. This will depend upon prices.

Professor SHAW. Isn't it better sometimes to feed an unbalanced rather than a balanced ration, and wouldn't it be possible for the farmers of Massachusetts to make more to-day by growing on their own farms and feeding an unbalanced ration, than by paying as they pay for the grain they buy in making a balanced ration?

Mr. LANE. I don't believe in putting too much stress on the balanced ration. What I mean is, I don't believe it is necessary to have it exactly 1 to 5 or 1 to 6 the year round; and there are times, as Professor Shaw says, when there is no doubt but what the dairyman will make more money by cutting down the purchased feeds and depending largely upon the foods grown on the farm. It doesn't cost him as much to feed his cows in that way; but he ought to feed a reasonably well-balanced ration the year round, and plenty of it. I believe you are right, — that a dairyman can very often take the grains and feeds off his own farm and make more money than by buying high-priced feeds.

QUESTION. Can you increase or decrease the amount of butter fat and solids by changing the feed? If so, how much?

Mr. LANE. You can't change the solids or fat in the milk a great deal. The amount of fat a cow puts into her milk is as natural to her as the spots on her back. It is born in her, and you can't change it very much by feeding; but if you go to extremes in the matter and give her very poor feed you create an abnormal condition, and you may change it a little, — not more than .2 of a per cent in fat. You will get variations from day to day, and you can't explain them, but it isn't the feed. There are other things that may affect the fat: if a cow has been scared by a dog, or is nervous, or has been out in the cold wind, — these things all have an influence; but when you come down strictly to the standpoint of the feed, you can't change the fat very much.

Mr. W. A. Kilbourn (of South Lancaster). I want to take exception to the recommendation of cement floors. I have known disastrous effects from them. I think such floors result in injury, not infrequently trouble in the bag causing difficulty, and causing the cattle to get cold. I have known of cases where I think cement floors resulted in a large proportion of the cattle coming down with tuberculosis. It is almost impossible to keep bedding under cattle on a cement floor. When they lie down and move a little the bedding will work away, and you will find their bare skins come in contact with the cement floor, and necessarily it is cold and uncomfortable. In our barn we have a cement floor, which is lined with plank, which, when they are somewhat worn, can be taken up and replaced; but the cement floor itself is a cold thing to have, and when my cows go out they are apt to slip upon it, and we are using sawdust over the cement to prevent the slipping.

Another point in regard to the cost of cleanliness and the proper ratio in the increase of price. To get what we call reasonably clean milk, the cost is about double, — that is, to take our dairies as they are ordinarily cared for by men who have other work to do in the regular working hours of the day. The cows are not very carefully taken care of, but where men give special care to the dairy, the herdsmen have to occupy the whole time; and it strikes me that a not unfair estimate of the increased cost is about double for the care and attention they should rightly receive.

Mr. Lane. I gave perhaps extremes, but they are actual figures obtained by studying the conditions where dirty milk was produced and where clean milk was produced.

I can't say I agree with you on the subject of cement floors, for I would rather take my chances with tuberculosis with a cement floor that can be cleaned, than with a plank floor that allows the manure and urine to go down through, making the conditions filthy and dirty. Of course there are arguments on both sides of the cement floor question; but hundreds are using them to-day, and never had the difficulties which you speak of, and they wouldn't give them up for anything. If I were going to build a barn to-day, I would certainly put in a cement floor, not only from a sanitary standpoint, but from the standpoint of economy.

Mr. Kilbourn. What do you think of individual drinking basins for cows?

Mr. Lane. That is a question where there is room for argument on both sides; but my opinion is, the individual drinking basin is a thing of the past rather than of the future. Most of the modern stables that are put up now are put up with a cement trough in front of the cows to drink out of. The water is allowed to run in perhaps a couple of times a day, then it is turned off. This method is considered more sanitary than the individual drinking basin, that allows the dust and dirt and filth to get into it, even with a cover on. I don't care how much you clean it, it isn't strictly sanitary. I believe the cement trough or modern method is a step in advance of the individual basin.

Mr. Kilbourn. If you have a tuberculous cow standing near the head of the line, how about that?

Mr. Lane. That is perhaps the only objection to the drinking trough, but the same might be said of the individual basin. A good many of them allow the water to run freely from one to another. I have seen two or three cows at one end of the stable drinking the water out of the basins all the way down the line.

Question. Is it your belief that the present method of storing manure in barns will be barred out within a very few years?

Mr. Lane. I appreciate the position of you dairymen here in Massachusetts. You have those barn cellars, and up to within a few years they have been O. K.'d by boards of health and everybody else, but we are getting a little more strict about this matter of sanitation, and I believe that the storing of manure in the barn cellar under cows will have to go; and if a man is building a new barn or remodeling an old barn, he should take that matter into account. If that change is made now by any dairyman, I believe he is taking a step in advance and doing something that will have to come anyway.

Question. Which of the two would you call more dangerous to the community, — thrown under the barn, or where it is thrown out of the window, with no shed over the manure, just the way we see it at old-fashioned barns?

Mr. Lane. If that barn cellar isn't tight, and the odors can come up through, I consider that more dangerous, although the other is pretty bad, too.

Professor Shaw. Which do you think would be more profitable to the Massachusetts farmer, — to draw his manure out every day in the year and spread it properly on his land, or to put it in the basement or the barnyard?

Mr. Lane. It is most profitable to put it on the land as soon as you can. There is no waste in fermentation, and very little loss. If your land is a side hill, the manure won't go very far; you will see a lot of colored water, but it won't have anything in it.

Professor Shaw. Whether you think there would be a greater loss of ammonia by drawing it and putting it on the land every day where it is to be spread, or putting it in the cellar?

Mr. Lane. I would take my chances on the spreading every time.

Professor Shaw. So would I.

Question. In the mortality of infants, what proportion of the deaths do you attribute to impure milk?

Mr. Lane. I have said to-day that in summer the principal cause of death of our infants is diarrhœal disturbances, and the principal cause of those disturbances is dirty milk. Many of these troubles are caused by the feeding of the milk at improper times, and I wouldn't say for a minute that they ought all to be attributed to the condition of the milk.

Mr. G. M. Whitaker (Washington, D. C.). As a loyal son of Massachusetts, it gives me a good deal of satisfaction to be here at this meeting, and to know that the Board is recognizing the importance of the market milk business by giving one of its sessions to the subject of market milk. It was also a matter of a good deal of satisfaction and pride to me, as a son of Massachusetts, in looking over the November "Review of Reviews," in an article headed "The milk supply as a national problem," to see that one of the leading magazines of the day thought that this subject of market milk was of enough importance to give it space in its pages, and also to treat it as a national problem, because my work in a great many different cities has emphasized that phase of it in my mind. But where I was particularly gratified was to find this: "Massachusetts was really the first Commonwealth to take official action looking toward the purification of the milk supply, and Boston is the pioneer of all American cities in securing the benefit of milk inspection." So that our State of Massachusetts, in which we all take so much pride, it would seem from that article stands prominent, stands pre-eminent among the States of the Union in the attention that is given to the market milk supply. I occasionally read in the papers of a little friction now and then between the producers and the Board of Health in this matter of milk inspection which is so favorably noticed in this magazine; and I have studied that a little, I have spent a number of days with the Board of Health inspector, studying his methods, and it seems to me, if any criticism at all is to be made, it is more in the matter of detail than otherwise. That is, the inspector goes to a man's place and looks it over, and the man says, "Do you find everything all right here?" and the inspector says, "That isn't for me to say; I must make my report to the secretary, and if it isn't all right, you will find out from him." I have been doing a great deal of work in inspecting dairies, and with the score card, in many different States and under a great many different conditions; and my theory is, as Mr. Lane has said, that the inspector ought to be a teacher and a friend to the producer, rather than a person holding a club over him; and it seems to me if the Board of Health should modify its methods enough so as to use that score card, or some score card, and the inspector should fill out the card in the presence of the producer, talking it over with him, and saying, "Now, Mr. A., you see that in cleanliness in the stable, for instance, 6 points is perfect; and you see those cobwebs around there and a little manure on the floor, — what is the fair thing to put down?" And the farmer says, "Give me 4 points for cleanliness." And the inspector says, "That agrees with my judgment;" and the farmer says, "When you come around again, you will find the barn whitewashed and the cobwebs down, but 4 is about the thing to-day." If he leaves a copy for the farmer and takes one home with him, it seems to me that will help the producer, showing him just where he loses a point here and there, and create a good, friendly spirit; for where a thing isn't understood there is always a chance for misunderstanding to creep in. If everything were put down in black and white on a score card, opportunities for friction would be very much less.

Secretary ELLSWORTH. Request has been made that the subject of forming local cow-testing associations be considered at this meeting. I can do no better than to present the following paper, and to ask Mr. Harwood of the Dairy Bureau to speak upon the matter.

# FORMING LOCAL COW-TESTING ASSOCIATIONS.

BY MR. G. C. SEVEY, SPRINGFIELD.

A pertinent question to-day is, Are you making money in the dairy? Are you getting returns commensurate with possibilities? If not, there are just two ways, and only two, by which your profits can be increased. You might obtain higher prices for your product, or you might lower the cost of production; either way is bound to mean increased profits. More is usually said about increased prices than about lowering the cost of production, and that, in my opinion, is where many make a grave mistake.

Briefly, and without frills, I call your attention to a method of greatly reducing your cost of production in the dairy herd. A big majority of you already know the method, but the trouble is that in too many cases you do not follow up that knowledge to your greatest advantage. I refer to weighing and testing the product of the dairy herd methodically and periodically. In a gathering of progressive agriculturists, like this, one need not waste time by pointing out the many advantages, and, in fact, the great necessity, of knowing which animals are "robbers" or "star boarders," and which are making a reasonable profit. You very well know that it is necessary nine times in ten, if the balance is to show on the right side of the ledger. Then why do you not do it? That is the question. I know some of you do, and I have yet to learn of a single man who gave up the little extra work this entailed after he had gotten a taste of the actual dollars and cents — cold cash — the practice returned him.

In my opinion, this seeming indifference of dairymen is easily explained. They have the impression that testing means a lot of money, time, bother and a gilt-edged education. The opposite is likely to be the case. A few weeks ago there was an important conference of dairymen at Amherst, Mass., which represented all the New England States; and as a result of that meeting, a simple, decidedly inexpensive and yet reliable means of testing cows was reached. This was based on the deductions made from 700 trials by Prof. J. L. Hills, director of the Vermont Agricultural Experiment Station. The plan includes just two things: weighing the milk of each cow three days a month; and the sampling of it twice or thrice during the year. Simple directions will be given, so that any farmer can do the weighing himself; and the testing will be done by creameries, experiment stations or through some other arrangement. Please note the simplicity of the plan. Each farmer who will take an interest in the work will be provided with a small card of instruction, so simply and carefully arranged that a school boy could do the work. The initial cost need not exceed $5 for a good-sized herd. Dues or fees, nominal or none. The same work for the second year will cost much less. You will see this does away with salaried men to do the testing, but it means many less times the work as usually conducted. The Denmark plan of salaried officials is probably a little more effective, but conditions are somewhat different in New England, and we must modify our plans accordingly. The essential thing is to get a start, and then we will have unlimited opportunity to grow and make a system as elaborate as seems advisable.

Do not make the mistake of believing that you can guess about what the individual cow is doing; there is too much "guess-so" dairying already. You may have seen figures recently published in "Hoard's Dairyman," giving the results of the performance of 100 herds selected from 6 different creameries, and representing approximately the average conditions therein. Of the 100 herds, there were only 38 that made a profit to their owners; 61 herds caused a loss; and 1 broke even. The average cost for an entire year of keeping the profit-making cows was $37, and the average cost of keeping the losing cows was $34.82, — a difference of a little over $2. Could there be a better argument for testing? I venture that New Hampshire is not the only State that will show such conditions. A short time ago a similar census showed approximately the same results in Vermont. Another test is being made in Maine, and when Massachusetts is reached I do not expect to see all of our herds on the profit side of the ledger.

Even if you are selling milk in the city, you are interested in this matter, — perhaps more especially in the matter of weighing than in the testing for butter fat. There is a difference whether your cows are giving 3,000 or 4,000 pounds of milk annually. Remember, there are but two kinds of cows: cows that make more than they eat and cows that eat more than they make. Get rid of the latter, and breed from the former. Concerted effort throughout New England is now being given on this subject, and do not miss the opportunity to identify yourself with whatever movement is decided upon for Massachusetts. Prof. J. L. Hills of Burlington, Vt., who is heading the movement, has been given a special place on all the programs of the State dairymen's associations in New England for this winter, and gratifying results are sure to follow.

Finally, I wish to heartily commend farmers for seeking better prices for dairy products, especially milk. The price of the last named is to-day ridiculously low to the producer, compared with the food value of other products. On the other hand, I firmly believe that if dairymen would give a little more attention to lowering the cost of production, as well as to advancing prices of the commodity, they would be far better off. The margin of profit would be just as pleasing to the producer, joyfully welcomed by the consumer, and the probabilities of profits made doubly certain.

Mr. P. M. Harwood (of Barre). This matter of cow-testing associations is a matter which was brought out at the recent meeting at Amherst primarily by Professor Hills of Vermont, and the idea is to establish such associations in different localities over the State, wherever the farmers are willing to co-operate, and have some one go out from time to time to test the milk with the Babcock milk tester and weigh the milk also, so an approximately correct idea may be formed as to the profitableness of the cows. It is a well-known fact that the people who have made such tests individually have been surprised at the results. They find that they have cows that pay a good profit, and some that barely pay expenses, and others that are boarders. It brings about an economical method of discarding the poorer cows by showing the owner what those cows are, and it naturally follows that such cows will be discarded. It seems to me it is a matter of missionary work. Professor Hills said he had been hammering on this question for two years, and he had accomplished but little. It seems to me the best results can be obtained through some live, active person in dairy localities taking up the work and establishing these local associations. I don't believe anything will come out of it unless something like that is done. I think in the western part of this State the creamery associations should take up the matter, and that through them something can be done. I am certainly heartily in favor of the project, and believe that it should receive the indorsement of this Board.

While I am up I want to say something about the present milk situation in Massachusetts. It is exceedingly important that this whole question be brought to an early solution, — the production of clean milk, and the handling of it in a way that is satisfactory to everybody. We don't like to admit it, but in my judgment the milk-producing industry in Massachusetts has not been reasonably profitable for some years, and this can be abundantly proven. When it is said, "We want clean milk; we want the milk delivered in Boston for the babies in just as good condition as it can be delivered back in the country towns," it opens a great question. It involves heavy expense, and that expense is met by people who have been producing milk at cost or less. Is it any wonder that the farmers are sensitive when they are asked to increase their expenditures in making this milk? The bottom trouble of the whole situation is the price of milk; and if Boston wants good milk, she must pay for good milk; and that is true of every city in this Commonwealth. I believe there is only one solution of this question, and that is summed up in the one word "co-operation;" if the producer and handler and consumer will get together and work shoulder to shoulder, they can solve this question in a rational and a reasonable way.

Mr. Albee. I move a vote of thanks be extended to Mr. Lane for the valuable assistance he has rendered the dairymen to-day.

Carried unanimously.

Adjourned at 4.40 p.m.

### Evening Session.

An evening session was held at 8 o'clock, Mr. W. A. Kilbourn of South Lancaster presiding.

The lecture was on "Massachusetts fruit trees and their insect foes," by Dr. Henry T. Fernald, State Nursery Inspector, and was illustrated by stereopticon.

# MASSACHUSETTS FRUIT TREES AND THEIR INSECT FOES.

BY H. T. FERNALD, PH.D., AMHERST, MASS.

Massachusetts is a natural fruit-raising State. On her rugged hillsides flourish magnificent trees never set by man, while thrifty pear and plum orchards here and there attest the value of her climate and soil for fruit growing. The qualities of the Baldwin, Hubbardston, Sutton Beauty and Roxbury Russet apples, of the Clapps' Favorite pear, of the Crosby peach and of the Concord and Rogers' Hybrids among grapes, are known the world over, and all of these and many others originated in Massachusetts.

Civilization and fruit raising at first went almost hand in hand in this country. After making a clearing in the forest, building his log cabin and breaking ground for his crops, the settler rarely neglected to plant a few fruit trees near his home; and in time the better fruits occasionally appeared on his table, while the poorer sorts supplied cider and vinegar for his use.

But fruit raising was always a side issue. His markets were always for his hay, corn, potatoes and the products of his cattle, and with little time at his disposal it was these which received his attention and the fruit trees were neglected, as the only market for fruit was in his family and perhaps with a few of his neighbors; and it is probable that the one who most appreciated the fruit was the "Barefoot boy, with cheek of tan," who munched his apple as he drove the cows to pasture at early morn.

In time the farms began to run down, and the struggle to raise sufficient crops became more severe, thus concentrating all the farmer's energies in his special lines, and the fruit trees suffered still more from neglect. By this time it had become almost traditional that in order to obtain fruit all that it was necessary to do was to set out the trees and then let them alone. In consequence, when fruit came into demand for table use it found almost all the farmers of Massachusetts with nearly worthless trees, fruit averaging poor in quality, and with insects and fungi rampant. In addition, it found the farmer without a knowledge of proper methods of fruit culture, and devoting his energies to other crops. As a natural consequence, fruit raising in other parts of the country, where more up-to-date methods were promptly adopted when the demand came, has increased rapidly; while the people of Massachusetts, with a few individual exceptions, have allowed their opportunity to pass rather than to master modern methods of fruit growing and obtain their share of this rapidly increasing and profitable occupation.

The demand for first-class fruit is now greater than the supply, and the export trade is calling for larger shipments. Much of this fruit now comes from west of the Mississippi River, has been grown in climates less perfectly adapted to produce fine quality and keeping properties than is that of this State, and has been shipped long distances at freight rates much higher than would be the case here. Over half of the first-grade fruit in Boston markets to-day has come from the west, while Massachusetts supplies the lower grades at correspondingly lower prices.

Failure to raise the best fruit here has given the west its chance; and this has been taken advantage of, the finest grades attractively packed now selling in Boston markets for more than twice as much as home fruit. Only last year Hood River apples were selling at from $2.50 to $4 per box, the boxes holding about a bushel, and retailing at some places in this city at $1 a dozen; while the best home apples available were selling at $2.50 per barrel!

There is no reason why this condition should continue. Massachusetts can raise just as good fruit as Oregon, and at less cost. With much lower freights to pay, less risk of injury during transportation, excellent soil and climate, it is only necessary that fruit raising should be undertaken as a business, on business principles, and with the determination to produce the very best fruit in existence, in order to establish a satisfactory market.

The difference in freight rates from points in this State to Boston, as compared with those from the west, is worthy of a moment's consideration. If a Kansas fruit raiser, for example, ships apples in carload lots to Boston for export, he pays from 25 to 35 cents per hundred pounds to the Mississippi River or to Chicago, and 30 or 35 cents more from there to Boston, his total freight being 60 or 70 cents per hundred pounds. The Massachusetts grower shipping in the same way would pay on the average 8 cents per hundred pounds, — a saving of nearly seven-eighths of the total shipping charges, as compared with the Kansas shipper.

It is high time for the farmers of Massachusetts to throw off the lethargy in which they have so long remained, and prepare themselves to occupy markets properly theirs, and which they can supply easier and better than can the residents of any other section of this country.

A recent editorial writer in the Youth's Companion has expressed his views upon this subject as follows: —

> The rapid development of the fruit-growing industry in this region is due to the great fertility of the soil, the intelligence and energy of the western farmers, and the co-operative organizations of growers. Poor fruit has been discouraged and almost eliminated. Packing is in boxes, with every apple wrapped separately, and warranted to be perfect. The number of apples which a box contains is printed plainly on the outside, and there is absolutely no "deaconing."
>
> These methods have enabled the western growers to realize a profit on apples and pears of $100 to $1,000 an acre. . . . There is no mystery about this remarkable development. It is due solely to intelligence, enterprise and hard work, and is just as much within reach of eastern growers as it was in the grasp of their western rivals. The lesson ought not to be lost upon eastern farmers who wish to retain such of their fruit market as still remains to them.

Even under present conditions, there are many persons in the State who derive three-quarters of their entire income from sales of their fruit. One such man, whose name would be familiar to many of those present, recently admitted that his trees are growing in sod land, without fertilizing, pruning except at long intervals, spraying or care of any kind; that the fruit is shaken from the trees, roughly assorted, packed in the cheapest barrels obtainable, and marketed whenever it is most convenient. Yet he acknowledged that nearly all of his fair income came from this fruit. The San José scale had recently appeared in his orchard, and he had about decided to cut down his trees and go into some other occupation, rather than make the source from which he received most of his income his real business. If this be a fair sample of the way in which fruit growing is conducted in Massachusetts, it is no wonder that the larger part of the best export and New England trade is supplied from the west.

At the present time fruit growing has unusually attractive prospects in Massachusetts. The general distribution of the San José scale over the State absolutely requires regular and persistent treatment. Now, fruit trees are grown by three classes of people: those who make it their business; those who, though in other lines of agriculture, raise a little fruit; and those in commercial or professional occupations, who have fruit trees in their yards to supply their own needs. The first class will fight this new insect foe, and get their fruit; but the farmer on other lines, after spraying once or twice, will usually give up treating his trees, as requiring too much time and trouble; while most of the third class, having no spraying apparatus to use and no knowledge how to use it, will probably try to hire the spraying done, and will generally find no one available to do it. In consequence, the trees thus left unprotected from this pest will die after a time, and the fruit raising in the State will be concentrated in the hands of the professional growers, and theirs will be the task of supplying the fruit now raised by the other two classes.

As the number of fruit trees around the houses of workers and grown by farmers as a side line only is now more than five times that of all those in the orchards of regular fruit growers, it is evident that the time is coming when fruit in large quantities will be in demand to replace that which will be lost, and the man who prepares now to meet this demand will reap the benefit.

From what has been stated, however, it does not follow that fruit growing is a simple occupation. The successful grower must thoroughly understand what conditions of soil and elevation are best adapted to the varieties he attempts to raise; which varieties bring the best prices in the markets he proposes to use; what kinds of plant food and the proper amounts of these his trees need in order to enable them to do their best work; how to prune, fight his insect enemies and fungous foes; and, last but not least, how to gather, assort, pack and ship the fruit in such ways as will help it to look best, keep best and sell best. Such a man can make a success of fruit growing in Massachusetts; and a man who fails to measure up to an equivalent standard, in whatever occupation he may be, is a failure to just that degree. If it be in business, he is likely to assign; if in a profession, he soon drops out of sight; but if a poor farmer in any line he generally earns a living, scanty though it may be, for nature will sustain inefficient workmen where in any other occupation this would be impossible.

Let us now consider some of the foes the fruit grower will meet in Massachusetts, and how he must combat them if he is to produce crops which will bring the highest prices.

One of the most important pests of the apple in Massachusetts is the codling moth (*Carpocapsa pomonella* L.), a native of Europe, but which has taken kindly to new world conditions. The caterpillar, when through feeding in the apple in the fall, leaves the fruit and crawls down the tree till it finds some piece of loose bark beneath which it can make its way. Here it gnaws an oval cavity, which it lines with silk, and in this space it coils up to spend the winter. During this time woodpeckers are of great value to man by seeking for

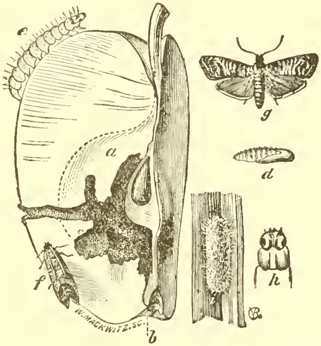

FIG. 1.—Codling moth: *a*, work of caterpillar; *b*, point of entrance; *d*, pupa; *e*, full-grown caterpillar; *f*, *g*, moth; *h*, head of caterpillar; *i*, cocoon.

these caterpillars as they lie under the loose bark and feeding upon them. When spring comes, the caterpillar changes to a pupa, and by the time the apple blossoms are falling the moth escapes from the pupa and begins to fly among the trees.

About a week after the petals fall, egg laying begins. The eggs are tiny white specks, placed singly, either on the fruit, its stem, or even on some leaf near by, and each moth may lay from 50 to 75 eggs. About a week later the eggs begin to hatch, and the little caterpillars crawl to the apples, if not already on them, and more than three-quarters of them pass to the blossom end. Here they gnaw their way into the space between the sepals, and begin to feed. After a day or two each starts in toward the core, around and in which it feeds till nearly full grown. It now makes a tunnel toward the surface. Arriving there, it forms an exit hole which it keeps closed with silken threads mingled with excrement till it has finished feeding, when it leaves the apple and crawls down the trunk till it finds a suitable loose piece of bark beneath which to pupate.

Some of the caterpillars, — perhaps 20 per cent, — however, do not enter the apple at the blossom end, but at some scar on the surface, where a leaf rubs against the fruit, or elsewhere. For these after they have once entered the apple the history is the same, but the difference in the place where they enter makes a great difference in treatment necessary. In either case nearly a month is spent in the fruit, and the first caterpillars appear to finish feeding about the first of July. After these have gone to the trunk and pupated, two or three weeks are spent in this condition before the moth appears. Later caterpillars, however, which are not ready to leave the fruit before August, usually remain in the caterpillar stage under the bark till the following spring; while the moths from the early caterpillars go to the trees and lay their eggs for a second brood, which works in the fruit during the fall months. The caterpillars of this brood pay little attention to the blossom end of the apple, but enter anywhere, and often do not finish feeding until after the fruit has been gathered, and are accordingly carried into the bins or barrels where it is kept, and on leaving the apples form cocoons in any convenient crevice in which to spend the winter. How important this second brood is in Massachusetts is not known, and the subject is now being investigated.

The entire amount of loss caused by this pest is seldom appreciated, as many of the apples attacked by the first brood fall off early, not remaining long enough on the tree to show what the crop would be. But even of those which remain to be gathered nearly 40 per cent on an average are wormy, reducing their value at least one-third. Pears, too, are attacked by this pest, so that in the aggregate the loss is very great.

To prevent much of this loss, spraying may be made use of, and at the same time secure protection from various fungous diseases, such as scab and fruit spot. But, in order to be a success, the proper time must be chosen for the treatment. It has already been stated that a large majority of the caterpillars of the first brood enter the fruit at the blossom end, where nature has provided a little cup in and around which to place a supply of poison. For about a week after the petals have fallen the sepals which form the walls of this cup remain open, but after that time they draw together, thus closing the opening. Before this happens, the tree should be thoroughly sprayed in such a manner that as much of the spray as possible shall fall into and around this place, so that when the caterpillar comes, its first meal may be a poisoned one. The best spray to use for this purpose is Bordeaux mixture, to every barrel of which two pounds of arsenate of lead have been added, thus treating both insects and fungi at the same time. Repeating this treatment about twenty days after the blossoms have fallen is also of much assistance, and should not be omitted.

In this way most of the caterpillars entering the fruit through the blossom end can be destroyed. But about 20 per cent enter elsewhere, and for these other methods must be employed.

As a large number of the small apples which fall are infested, and once on the ground will soon be left by the caterpillars, it is important that these apples be picked up and destroyed, either by hand or by letting fowls or hogs run freely under the trees. For those caterpillars which leave the fruit before it falls it is well to scrape the trunks and large limbs of the trees about the middle of June, to remove all loose bark beneath which they might pupate, and tie a strip of burlap around the trunk. Beneath this strip the caterpillars will gather, and a weekly visit and the destruction of the caterpillars there, while not saving the fruit they fed on, will at least reduce the number of these insects, and be of value as a protection against later broods.

Spraying twice, burlapping and destroying early falling fruit are the protective measures to be adopted for this pest. Recent experiments in New Hampshire show an average profit per tree sprayed, over one not sprayed, of $1.25, while it cost less than 25 cents to spray a tree four times; and after deducting one tree's share of one-fifth of the cost of the apparatus used on a hundred trees, the net profit of a sprayed tree over one not sprayed was about 80 per cent.

These results have been tested in all parts of the country, and are but little better than the average; and if this be so, the question is no longer, "Can I afford to spray?" but "Can I afford not to spray?"

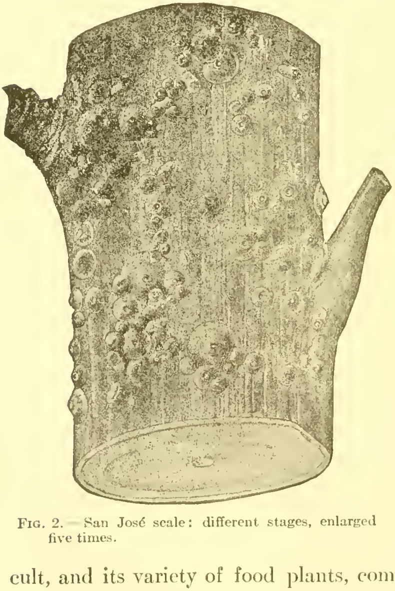

FIG. 2. — San José scale: different stages, enlarged five times.

Another and even more destructive enemy of the fruit grower is the San José scale (*Aspidiotus perniciosus* Comst). Its extremely small size, its marvelously rapid increase in numbers, its covering of armor which makes destruction so difficult, and its variety of food plants, combine to render this a most dangerous foe. It lives not only on the bark, which it finally covers completely, but it spreads to the fruit, where it produces unsightly red spots, so injuring its appearance as to greatly reduce its value for sale.

This scale is now generally present in Massachusetts, and is rapidly becoming more abundant.

It is one of the most prolific insects known, the descendants of a single individual under favorable conditions having been calculated as numbering more than three billions in a single season; and as all of these obtain their food from the sap of the tree, it is not uncommon to see good-sized trees completely dried up as the result of their presence. They can be destroyed only by sprays which come in actual contact with their bodies, and strong enough to penetrate the armor which covers them; and sprays which can do this are not safe to use on the trees except during the winter months, while the trees are not growing. Yet a fruit raiser who understands the proper meth-

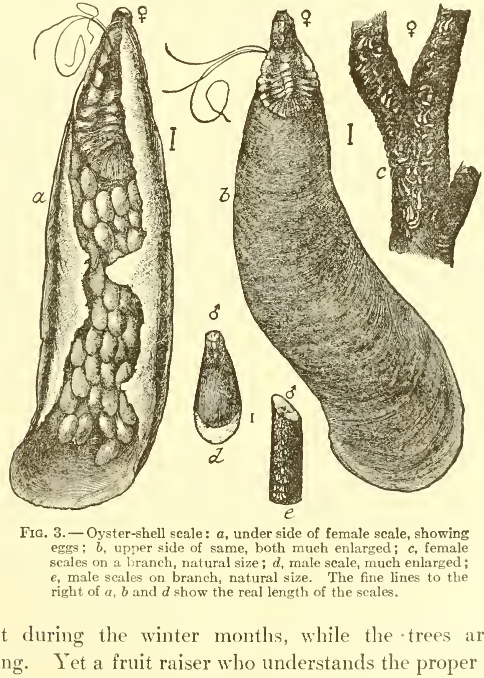

FIG. 3. — Oyster-shell scale: *a*, under side of female scale, showing eggs; *b*, upper side of same, both much enlarged; *c*, female scales on a branch, natural size; *d*, male scale, much enlarged; *e*, male scales on branch, natural size. The fine lines to the right of *a*, *b* and *d* show the real length of the scales.

ods of treatment has no fear of this pest; and to him, as Mr. J. H. Hale says, it is on the whole a blessing in disguise, for it means that this pest will destroy so many of the fruit trees which are not given proper care as to greatly increase his markets and improve his prices.

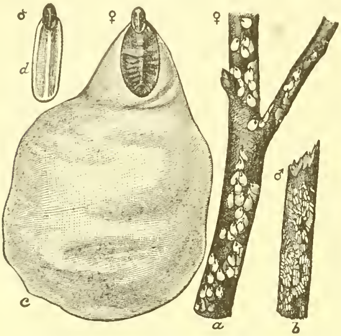

Fig. 4. — Scurfy scale: *a*, female, *b*, male scales, natural size, on twigs; *c*, female scale, much enlarged; *d*, male scale, much enlarged.

Two other scales are also frequently present in the orchard, and at times may cause trouble. The oyster-shell scale (*Lepidosaphes ulmi* L.), being larger than the San José scale, is more frequently noticed and feared by those not familiar with the subject. But this fear is unnecessary, for the oyster-shell scale increases slowly in numbers as compared with the other, and mild soap washes applied in June are sufficient to hold it in check. The same is true of the scurfy scale (*Chionaspis furfura* Fitch), the dirty white color of which makes it very noticeable. Trees attacked by these scales must be treated,

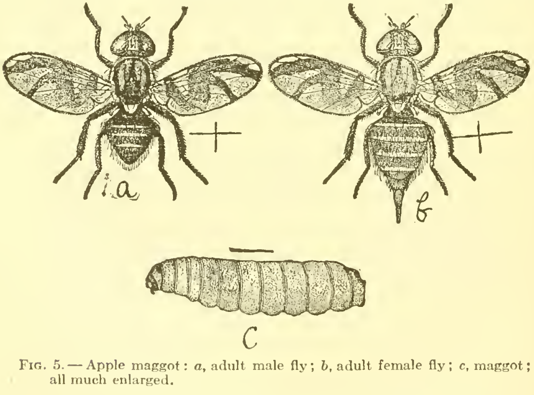

Fig. 5. — Apple maggot: *a*, adult male fly; *b*, adult female fly; *c*, maggot; all much enlarged.

it is true, but two applications in June should be amply sufficient to prevent any loss from their ravages.

The apple maggot or railroad worm (*Rhagoletis pomonella* Walsh) is another pest which causes much trouble in Massachusetts. The adult is a fly, smaller than a house fly, with black bands on its wings, which lays its eggs just under the skin of the apple. This begins early in July and continues till late in September, different individuals appearing at different times during this period. The young maggots from these eggs tunnel in all directions through the fruit, the earlier tunnels healing and closing up, but later ones remaining open and turning brown, while the fruit becomes soft and worthless. When full grown these maggots leave the apple and enter the ground, where they pupate an inch or more below the surface. Sometimes they leave the apples after these have been gathered, and in such cases pupate on the bottom of the bin or barrel in which the fruit is stored.

The protected life of this pest makes it difficult to combat, the most exposed period being while it is in the pupal stage. The plan suggested for the codling moth, of gathering and destroying fallen fruit promptly, and of letting fowls or hogs run in the orchard, is also of value for the railroad worm, as many of the maggots in the fallen apples — those leaving it for the ground and those pupating in the ground — are quite certain to be found and eaten by these animals.

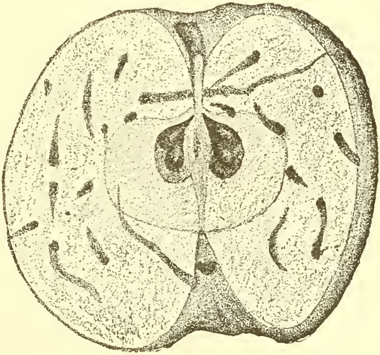

Fig. 6. — Apple showing work of the maggot.

All parts of trees are attacked by insects, and the apple is no exception to the rule. With the codling moth and railroad worm injuring the fruit, the scale insects sucking the sap from the branches and twigs and various other pests consuming the leaves, it would seem as though the trunk and roots at least should in fairness be exempt from injury; but this is not the case. The apple-tree borer (*Saperda candida* Fabr.) devotes its attention to the trunk near its base, and is an important foe, particularly in young trees. This beetle, which is strikingly marked and very noticeable, is rarely seen, being retiring in its habits. The eggs are laid here and there on the lower part of the trunk during the summer; the borers which hatch bore into the wood, where they make flat cavities just beneath the bark, which often cracks at such places, letting the "sawdust" out, and thus showing where the borers are. The following year the borer makes a regular tunnel into the wood of the tree, and finally gnaws out to the bark only a thin layer of which it leaves in place. Having thus prepared a means of escape for itself, it goes back in its tunnel a short distance, turns so as to face outward, and changes to a pupa, from which the following June or July the beetle escapes, follows the tunnel to its end, and, gnawing away the thin layer of bark, begins its life outside the tree.

That this insect is capable of causing great damage is shown by the fact that neglected trees are often completely girdled by the tunnels of the borers, and are killed; and even those not so seriously affected have their bearing power and general vitality greatly reduced. Yet treatment for these insects is simple, and takes but little time. In order to carry out this treatment, it is first necessary to remove any borers already in the tree; and this should be done in October, by searching for "sawdust," and then locating and killing the borers either with a knife or a pointed wire. Each tree should then be protected by wire mosquito netting, placed around the trunk so that it will not touch the trunk except at the top, about two feet from the ground, where it should fit tightly enough to prevent the beetle from crawling down inside. The wire should form the surface of a cone, the trunk coming up through its center, while the lower edge of the wire should enter the ground. With wire so placed, and with no holes in it, the beetles are unable to reach the lower part of the trunks on which to lay their eggs; and rather than lay them higher up they will in most cases leave such trees, and, crossing the line fence, attack the unprotected trees of neighbors. Such a protection will not only keep out borers for several years before it gives out, but will protect the trees in winter from the attacks of mice and rabbits, while also permitting light and air to reach this portion of the trunk.

During the fall months the fruit grower frequently finds certain parts of the limbs of his fruit trees more or less covered with a white wool, beneath which investigation shows the presence of large numbers of small plant lice (*Schizoneura lanigera* Haus.). These lice suck the sap from the tree, and locate, if possible, where the bark has been broken or rubbed, it being easier at such places to reach the sap than elsewhere. This insect is not usually a serious pest in Massachusetts; but as it also works on the roots and may do considerable injury there, its presence on the branches is an indication that the roots may also be suffering, and should be examined. To do this, the soil should be carefully removed till enough of the roots is exposed to determine their condition. If the lice are present, the earth should be removed down to the upper roots for a distance of two feet from the trunk in all directions, and this area well saturated with 15 per cent kerosene emulsion. The earth should then be put back, and the emulsion left to work through the ground to the lice.

In August and September caterpillars of various kinds feed on the apple leaves, often in clusters, and are quite conspicuous because of their bright colors. One of these is the yellow-necked apple-tree caterpillar (*Datana ministra* Dru). When disturbed this caterpillar lifts both ends of its body at right

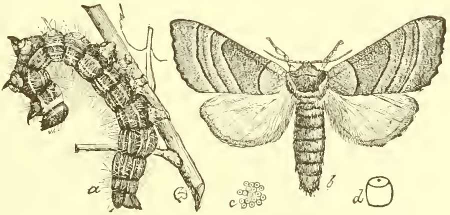

FIG. 7.—Yellow-necked apple-tree caterpillar: *a*, caterpillar, showing characteristic position when disturbed; *b*, adult moth; *c*, cluster of eggs, natural size; *d*, side view of one egg, much enlarged.

angles to its middle, assuming a very characteristic attitude. After feeding till full grown, the caterpillars enter the ground and pupate, the moths appearing the following summer.

In some cases another kind of caterpillar having similar habits, and known as the red-humped apple-tree caterpillar (*Schizura concinna* S. & A.), is met with, also feeding in clusters. Of this, too, there is but one brood a year, the moths flying in midsummer.

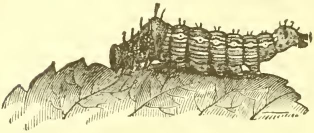
FIG. 8.— Red-humped apple-tree caterpillar.

Such caterpillars as these cause much more apprehension than is necessary. Their habit of feeding in clusters makes it easy to remove them by hand; or if for any reason this is impossible, spraying the portion of the tree they are on with arsenate of lead will quickly destroy them. But the size of the clusters and the rapidity with which they will strip a limb are often the cause of much anxiety to fruit growers who are not familiar with them.

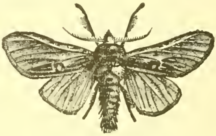
FIG. 9.— Moth of red-humped apple-tree caterpillar.

One of our abundant apple pests is the bud moth (*Spilonota ocellana* Schiff.). Though its work is generally little noticed, it blighted about 10 per cent of the fruit buds at Amherst last spring, besides many of the leaf buds, thus causing a large reduction of the crop, which was almost entirely unappreciated, the blossoms failing to develop.

The tiny moths of this insect measure less than an inch across the expanded wings. They appear in June and July, and lay their eggs on the leaves, generally singly. About a week later the eggs hatch, and the little caterpillars attack the leaves they are on, feeding on the epidermis of one side and the inside cells only, leaving the veins and other surface entire. Each caterpillar also forms for itself a little tube of silk, usually along the midrib of the leaf, and uses this as its home, leaving it to feed, but returning to it when disturbed. As the caterpillar grows, this tube is enlarged till it may become nearly an inch long.

Feeding thus, the caterpillar lives and grows till late in August or into September, the parts of the leaves which have been more or less skeletonized in this way turning brown and becoming noticeable. Late in September or in October, however, the caterpillar seems to realize that the leaf is no place on which to remain longer. It accordingly travels to a twig, where it seeks for some angle or corner, and here it encloses itself in a little web of silk in which to spend the winter.

When the buds begin to open in the spring, the caterpillars, now about half grown, leave their winter nests, being about a quarter of an inch long and dark brown in color. They pass to the leaf and flower buds, in which they feed, consuming the tender leaves or flower buds, and fastening them together with threads of silk. A caterpillar rarely eats an entire leaf or flower, but feeds for a time on one, then on another, thus blighting much more than it actually consumes. Sometimes it develops a burrowing habit, starting near the base of the bud and working down in the pith of the twig, causing the death of the entire tip of the shoot.

Those caterpillars which do not appear in spring till a little later select well-advanced leaves, the stems of which they partially cut off so that they wilt. Such leaves are then rolled up on one side and held by silk threads. In these the caterpillars live, and in feeding draw neighboring leaves close and fasten them together, thus constructing small nests.

The caterpillars feed for nearly two months in the spring before becoming full grown. When this condition has been attained, pupation takes place, either in a partially rolled up leaf, between two or three partially eaten leaves bound together with silk, or even on a leaf or twig, the cocoon in such cases being covered with the woolly growth natural to the smaller twigs or leaf stems. About ten days are spent in the pupal stage, and then the moth appears, and eggs are laid for another generation.

The importance of the bud moth as a pest has not been generally realized by most apple growers, as the estimates of the crop made are usually either from the abundance of the blossoms or from the newly set fruit, and both of these come after the attacks of the bud moth have caused the blighting of the blossoms.

To destroy the codling moth, we should spray at such a time that the first meal of the tiny caterpillar shall be a poisoned one. Similarly, to destroy the bud moth the spray should be applied to the leaf and flower buds shortly before they open; and as this is also a proper time to spray for certain of the fungous diseases, besides aiding somewhat in the control of the plum curculio, which is now paying altogether too much attention to the apples, a spray of Bordeaux mixture and arsenate of lead, applied to the trees as soon as the buds are beginning to open well, is necessary. Later in the season the habits of the bud moth caterpillar are such as to make it almost impossible to reach them, and this early spraying is our only method of control which is of much value.

Whether the Prophet Joel, when he wrote, "That which the palmer-worm hath left, hath the locust eaten; and that which the locust hath left, hath the canker worm eaten; and that which the canker worm hath left, hath the caterpillar eaten," referred to the canker worm of modern times, is unknown; but there are many who can testify that at times the canker worm has left nothing for the caterpillar to take. Fortunately, the canker worms are rarely of much importance in orchards which are carefully watched, and even when abundant they can easily be held in check, because of certain peculiarities of their life and habits.

Both the fall and the spring canker worm are found in Massachusetts, the former being probably the more common, at least in the eastern part of the State. The caterpillar in both species is what is commonly called an "inch-worm;" in both it leaves the tree when through feeding, and changes to the adult moth in the ground; in both the female moth is without wings; in both the eggs are laid on the twigs of the trees; and finally, in both the caterpillars feed at the same time of year. Here, however, the resemblance ends.

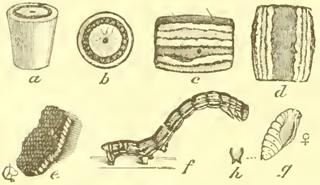

FIG. 10. — Fall canker worm: *a*, side view of single egg; *b*, top view of same; *e*, egg mass, natural size; *f*, full-grown caterpillar; *c*, *d*, *g*, *h*, structural details.

The fall canker worm (*Alsophila pometaria* Harr.) appears late in the fall, coming out of the ground; and the wingless females crawl up the trees to the smaller limbs, where the eggs are laid in clusters. In the spring these eggs hatch, producing tiny "inchworms," which feed on the leaves till full grown, this condition being reached in June. They then crawl down the tree or spin down a thread to the ground, where a few inches below the surface they pupate. Here they remain till the approach of cold weather, when the insects, now in the moth stage, leave the ground and pass to the trees to lay the eggs for the generation of the following year.

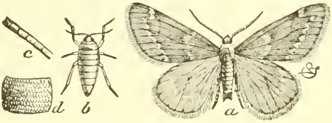

Fig. 11. — Fall canker worm: *a*, male moth; *b*, female moth; *c*, *d*, structural details.

In the case of the spring canker worm (*Paleacrita vernata* Peck.) the moths do not appear in the fall, but during the first warm days in March and April; and, like the others, the females crawl up the trees to lay their eggs on the twigs, and it is possible that a cluster of freshly laid eggs of the spring canker worm may be placed close beside a cluster of eggs of the fall canker worm which have been there all winter. The eggs of both kinds will hatch at about the same time, however, and their feeding will also be complete at about the same period; but, while the spring canker worm will then remain in the ground till the following spring, the fall canker worm will spend but a few months there, the winter being passed in the egg on the twigs.

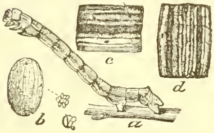

Fig. 12. — Spring canker worm: *a*, full-grown caterpillar; *b*, enlarged egg, and part of a mass, natural size; *c*, *d*, structural details.

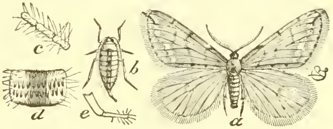

Fig. 13. — Spring canker worm: *a*, male moth; *b*, female moth; *c*, *d*, *e*, structural details.

From the above it is evident that any treatment which will prevent the wingless female from ascending the tree to lay her eggs will be successful, and for this purpose sticky bands and metal deflectors are much used. It is essential that no space should be left through which the insect may crawl above the protector, and the bands must not be allowed to dry. For this last reason tar and printer's ink, which were formerly much used, are now being abandoned in favor of tree tanglefoot, while the metal deflectors, which are hard to fit closely to irregular trunks and frequently get out of order, besides being quite expensive, are also disappearing.

The time at which the band should be applied depends upon the species of canker worm for which it is used. As the fall canker worm moth crawls up the trees in October and November, the bands should be put on about the first of October and be kept sticky till about Thanksgiving time. For the spring canker worm they should be applied about the first of March and be kept in effective condition till the end of April.

In case the fruit grower is unaware of the presence of these insects until they have begun their feeding on the leaves, spraying with arsenate of lead will quickly check their ravages; and, as the spraying for the codling moth will have been recently made, both insects will be reached by the same application.

During the present year the caterpillars of the hickory tiger moth (*Halisidota caryæ* Harr.) have been unusually abundant. Their contrasting colors attract attention against a background of green leaves, and their size when full grown is such that they can consume a considerable amount of food. They feed ordinarily on the hickory, walnut, elm and other shade and forest trees, but at times are quite abundant in orchards, particularly on the plum trees. The moths appear in June, but, as they fly only at night, are not often seen. The eggs are laid in clusters on the under side of the leaves, and the caterpillars at first feed together, but as they grow older scatter in different directions and often to other trees. They become full grown in September, and then seek for sheltered places, where they spin their cocoons in which to spend the winter and following spring till it is time for the moths to appear.

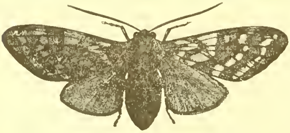
Fig. 14. — Hickory tiger moth.

The presence of the caterpillars of this insect is not often of any great importance; but when they become so abundant as to defoliate a tree to any great extent, it is well to check their ravages either by a little hand picking or by spraying with arsenate of lead, which will quickly destroy them.

The San José scale, codling moth, canker worms, bud moth and several others of the insects already considered are as likely to be found on the pear as on the apple, but the pear psylla (*Psylla pyricola* Först.) appears to depend almost exclusively upon the pear for its food. This tiny insect, less than a sixteenth of an inch long, and without colors to make it conspicuous, may be abundant in a pear orchard long enough to make its presence seriously felt, and even to cause the death of the trees, without its presence being suspected unless the owner is on the watch for it. It was probably brought to Connecticut from Europe on an importation of young pear trees in 1832, since which time it has spread everywhere through New England and as far west as Michigan and Illinois.

The insect passes the winter in the winged adult condition, hiding under loose pieces of bark, in crevices, or anywhere it can find protection. After a few warm days in spring the eggs are laid, chiefly near where the leaves of the previous year had been attached to the twigs, and in creases on the bark. The eggs, which are orange yellow at first, are attached to the tree by a short stalk, and are so small that eighty would need to be placed end to end to measure an inch.

The length of time spent in the egg is dependent upon the weather. If this be warm, the eggs may hatch in two weeks; but if it be cold, the young may not appear for over a month. When they do appear, however, they crawl to some suitable place and begin to suck the sap from the tree, seeming to prefer the angles between the leaf and fruit stems and the twigs to which these are attached; and as larger numbers appear later in the season they "overflow" from these places to the under side of the leaves and on the leaf stalks. While feeding, the young produce quantities of a sweetish, sticky fluid called "honey dew," which drops onto stems, leaves or the ground beneath the tree, and gradually dries. Ants, wasps and bees find this material much to their taste, and gather in large numbers to feed upon it. In some cases when the psylla is particularly abundant such quantities of honey dew are produced that it falls like a fine rain, and in any case when it dries it forms an ideal place in which a black, sooty fungus may grow, and this gradually turns such places black, and gives the leaves and twigs the appearance of having been covered with soot. This fungus does not itself attack the tree, but where it is present it and the honey dew close up many of the openings through which the tree obtains its air, and thus indirectly affect its health.

The young psyllas suck the juices from the tree, and molt several times during their growth as their skins become too small, and after about a month at one of these molts the adult insect is produced. Egg laying for another brood now follows, and the eggs hatch in eight or ten days, because of the warmer weather which has now arrived. About a month later the adults of this brood appear, and we may have as many as four broods in Massachusetts before winter puts a stop to this process.

The effect of the feeding of these little pests upon the tree is to a large degree dependent upon their abundance. In general, trees attacked fail to make much new growth, but remain at a standstill. The quantity of fruit produced and its size are also determined to some extent in this way, while in severe cases the leaves turn yellow, the fruit drops from the trees when partly grown, and many of the buds die. In one case, where a pear orchard in the spring promised a yield of about twelve hundred barrels, the actual yield was less than a hundred.

Numerous methods for the control of this insect have been tested, but only one has given satisfaction, and this is kerosene emulsion. About the 15th or 20th of May, or as soon as the leaves are well expanded and the young have begun their work, one part of kerosene emulsion diluted with twenty-five parts of water, applied with a nozzle which will give a fine mist, has proved very effective against all the young psyllas it reaches; and when a thorough application has been made at this time, the later broods are so small that they may safely be neglected. Where this treatment can be given soon after a heavy rain, the results are better than is otherwise the case, the rain washing off much of the honey dew, which, when it is abundant, somewhat interferes with the best results of spraying in this way.

Every one who has attempted to raise peaches has had an unpleasant experience with the peach borer (*Sanninoidea exitiosa* Say); but few are aware that the adult of this borer is a pretty moth so closely resembling a wasp that De Geer wrote of it nearly a century and a half ago: "When I saw the moth for the first time, I dared not take it with the naked hand, so sure was I that it was a wasp."

These moths begin to appear about the tenth of July in Massachusetts, but specimens are often observed as late as September, indicating that different individuals appear during quite a long period. They fly freely during the daytime, in this regard departing from the habits of most moths, and adopting those of the wasps they so closely resemble.

The eggs of the peach borer are laid during July, August and perhaps in the early part of September, on the trunks of the trees. As a rule, they are laid singly and on the lower two feet, though in some cases they may be placed higher, and no particular place is selected for their deposition. They hatch in a week or ten days, and the borer at once works its way into the bark, but seems to try to reach the base of the tree for this purpose. During the fall it feeds on the inner bark till cold weather approaches, when it becomes quiet either where it fed or beneath a thin covering it prepares on the outside of the bark near the ground. In the spring feeding is resumed, and most of the borers become full grown in June. They then leave the tree, and at its base spin brown cocoons within which the borer changes to the moth, this change requiring about three weeks. At the end of this period the end of the cocoon is broken open and the moth escapes, leaving its empty case behind.

The work of the borer in the tree is very noticeable after a little time, quantities of gum being poured out from the wounds; and the presence of this gum at the base of the trunk or elsewhere is of itself sufficient to lead to the suspicion that borers are at work there. In such cases the gum should be scraped away, all splits or openings in the bark investigated with a knife, and any borers found in this way should of course be destroyed.

Various methods for protecting the trees from this pest have been tested with varying but usually unsatisfactory results, and the best treatments now known are cutting out the borers about the first of May, then mounding up the earth around the trunk to the height of about eighteen inches early in June, and leaving this mound till the end of September.

In just what way this mounding prevents the attacks of the borer is unknown, but in such trees their numbers are greatly reduced, and when combined with cutting out in the spring excellent results are obtained.

But peach trees should not be the only ones watched for this insect, as it also attacks plums and cherries; and these also should therefore be examined every spring, and any borers found in them be destroyed, to prevent the peach orchard being annually restocked with this pest.

Every plant has its insect enemies, but, though the number of these differs with different plants, in each case one or two are of prime importance. It is probable that nine out of every ten fruit growers, if asked to name the most serious foes of the apple, pear, peach and plum respectively, would agree upon the San José scale; and after this would select the codling moth for the apple, the pear psylla for the pear, the borer for the peach and the curculio for the plum. Yet it is doubtful if more than two or three of the nine persons making this selection would know the adult plum curculio if they saw it. Its small size, its inconspicuous colors and its habits combine to aid it in escaping notice, but the work it does makes this pest an important one.

The plum curculio (*Conotrachelus nenuphar* Herbst.) is a small snout beetle, one of a group containing many important pests, among them being the cotton boll weevil of the south. It appears in early spring soon after the buds open, coming from the protected hiding places in which it has spent the winter months, and, flying to the plum trees, feeds to some extent upon the tender leaves while waiting for the fruit to grow. When this has taken place the beetles pass to the little plums, and here and there deposit their eggs. This process is at least suggestive of the exercise of some intelligence. The beetle, having selected the spot where an egg is to be placed, attacks the plum at that spot with its snout, working this in until a hole has been made, and at the bottom of the hole deposits an egg. This egg is very small and also very delicate, while the flesh of the plum at this time is very firm, and as the fruit grows rapidly the hole would soon close up and the egg would be crushed if the process ended at this point. The curculio appears to appreciate this, and to prevent such a result at once proceeds to cut a slit like a crescent in the plum close by the egg. The flesh of the fruit between the hole and the slit is in this way so far cut off from the remainder of the plum that instead of remaining hard it wilts and becomes soft, and in this way all pressure and consequent crushing of the egg is prevented. After an egg has thus been deposited and protected from destruction the beetle moves off to repeat the process elsewhere, each female laying from 50 to 100 eggs.

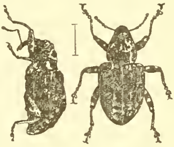
Fig. 15. — Plum curculio.

The eggs hatch in a week or so, and each little grub thus produced works into the plum till it reaches the stone, around which it feeds until it has reached its full size, which usually requires about three weeks. During this period the puncture and slit on the surface have nearly always become at least partly covered by gum which has escaped from these places, the gum accordingly marking where the curculio has been at work; while the feeding of the grub around the stone very often injures the plum so that it falls off at about this time.

This dropping of infested plums is very convenient for the grubs in them, for when these are full grown they generally find themselves on the ground with the fruit, which they now leave, working their way into the soil a short distance, where they pupate and after about a month reappear, now as the adult beetle. If the plum has not fallen the same thing happens, except that the grub falls alone instead of inside the fruit. How the adult beetles pass the fall is not known, but, as they are not noticed on the trees at this time except perhaps for a few belated individuals of the first brood, it is not probable that they are doing much injury except where they puncture apples for food. When cold weather comes it seems certain that they find hiding places to spend the winter.

During years when these insects are abundant, 70, 80 or even 90 per cent of the plums may be destroyed or injured by their attacks. Not satisfied with this, they puncture cherries and apples also; and recently their work on the latter fruit has become so marked that the plum curculio is now considered quite an important apple pest. It lays its eggs in the fruit, causing many apples to fall off early, and the beetles which are produced in the summer also feed upon them, producing unsightly blemishes which seriously reduce their value.

No one method of treatment will suffice for this pest. Spraying with the arsenate of lead just before the blossoms open gives good results, as the leaves, upon which the beetles feed more or less while waiting for the fruit to form, will thus be covered with poison. In the case of the apple this treatment combined with Bordeaux mixture has already been advised for the bud moth, so it is not in reality an addition to the treatments. A second spraying after the blossoms fall should also be given, and has already been advised for the control of the codling moth; and the second spraying for this pest will also help control the curculio.

It is very possible, however, that these treatments may be only partially successful because of rainy weather, and it is often desirable to resort to the "curculio catcher." This is practically a large frame covered with white cloth, placed beneath the tree, which is then suddenly jarred. During the greater part of the day and even during the warm nights the curculios fly quite freely, but for some reason they are very sluggish early in the morning and about sunset. At such times they will fall from a jarred tree without taking flight, and may easily be gathered from the cloth beneath and crushed.

As many of the grubs fall to the ground in the fruit, and all of them enter the ground to pupate, fowls and hogs permitted to run through the orchard, as was suggested for the apple maggot, will destroy large numbers of these insects; and spraying, jarring and the utilization of these animals will, taken together, be an effective check upon the ravages of the plum curculio.

The fruit grower who examines his trees during the winter months will frequently notice a dead leaf still adhering to some twig, and this should at once arouse his suspicions that insects are present. Sometimes the leaf is one which has for some reason retained its normal attachment to the tree; but an examination will usually show that it has been fastened in its position by silk threads, and that a cluster of eggs is also present. If the eggs are in plain sight, they are probably those of the old tussock moth (*Notolophus antiquus* L.). If only a hard white crust shows, however, in which the eggs are concealed, this is an egg cluster of the white-marked tussock moth (*Hemerocampa leucostigma* S. & A.). Both of these insects are quite general feeders, but are often found on fruit trees;

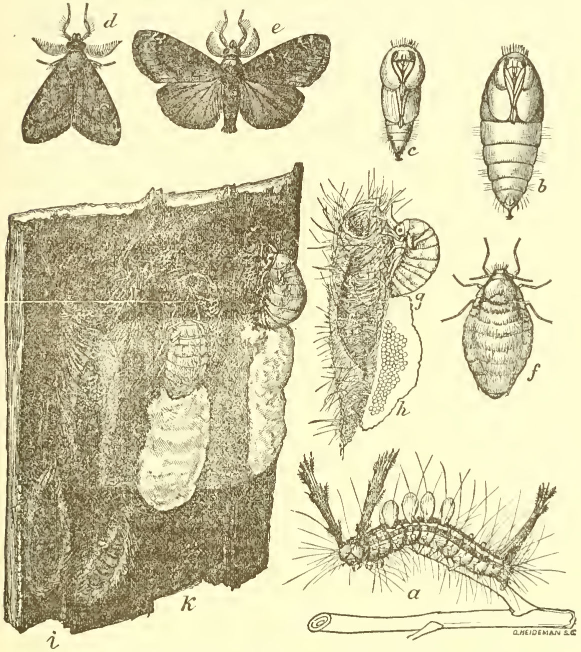

Fig. 16.—White-marked tussock moth: *a*, caterpillar; *b*, female pupa; *c*, male pupa; *d*, male moth; *e*, same, wings spread; *f*, female moth; *g*, female moth on cocoon; *h*, egg mass with froth over it; *i*, cocoons on tree trunk; *k*, same, showing females and egg masses also; all slightly enlarged.

and their egg clusters are frequently mistaken for those of the gypsy moth.

The eggs of the white-marked tussock moth are laid in the fall, often on twigs, but perhaps more frequently on the trunk or limbs of the tree on the old cocoons from which the female moths have escaped. The eggs are covered with a white froth which rapidly hardens, forming a crust which entirely conceals the eggs, but which is itself very conspicuous. The winter is passed in this condition, the eggs hatch in the spring, and the caterpillars feed upon the leaves until they are full grown, this condition being reached sometime about the middle or end of June. They now spin their cocoons on the trunk, limbs or twigs, and in this stage remain for two or three weeks, at the end of which time the moths escape.

The male moth is winged, and flies freely; but the female, being wingless, remains on the cocoon from which she escaped, and on this cocoon lays her eggs for a second brood, covering them with white froth, and dies upon the completion of this process.

The eggs thus laid soon hatch, and the caterpillars feed till the middle of August, when they also form cocoons, from which the second brood of moths escapes about the end of the month. Egg laying then follows as before, but these eggs do not hatch till the following spring.

The life of the old tussock moth is so similar to this that it need not be outlined; but the caterpillar, though bearing the tufts or tussocks which have given these insects their name, is quite different, its color being more quiet and rendering the insect less noticeable.

Destruction of the egg masses by hand is generally easy as a method for the control of the tussock moths, and, as they remain on the trees from September until the following spring, there is plenty of time available for their removal. If the insects are first noticed while feeding, however, the sprays for the codling moth should prove entirely efficient to hold them in check, and it is only where neglect prevails that the tussock moths are of much importance for any length of time.

Though eighteen insect enemies of our fruit trees have just been considered more or less in detail, these form but a small part of the total number of the foes the fruit grower has to meet. Nearly four hundred different kinds of pests may feed upon the apple, while the pear, plum, peach and the other fruit trees all have their share. That this alone should discourage the fruit grower is but natural, but a little consideration will show that each treatment is effective for several different insects. Bringing these together, it becomes evident that for the apple spraying with arsenate of lead and Bordeaux mixture just before the blossoms open, again a little less than a week after they have fallen and again about two weeks later, should give a large measure of relief from most of the important pests except scale insects; while for these one winter wash of the lime and sulfur mixture thoroughly applied will be sufficient to check the San José scale, and a mild soap wash in June should accomplish the same result for the others. And if it still seems as though the odds are against the fruit grower in Massachusetts, we must remember that equally serious foes, most of them the same, occur in the west, but do not prevent the man who means business from raising his fruit, shipping it to the east at high cost and selling it at high prices. The Kansas, Iowa and Oregon fruit growers have few advantages over those of Massachusetts; while the latter have home markets, cheap freights, and a climate and soil not excelled anywhere in the world for this purpose. The real difference to-day is that the western fruit sold here and exported is produced by business men who are in this business for every cent it is worth, who apply business methods to every part of their work, and who propose to furnish the finest fruit for the highest prices. How long this shall continue depends entirely upon the ability, energy and enterprise of the Massachusetts farmer.

## THIRD DAY.

The session was called to order at 10 o'clock A.M. by Secretary Ellsworth, who introduced Mr. Warren C. Jewett of Worcester as the presiding officer.

The CHAIR. I think you will all agree that we have had a very successful meeting, and that every one of us has had an opportunity to learn something about our business. I believe this morning's topic is perhaps one of the most important we have had, because I believe success upon the farm depends as much upon our help as anything else. If we have poor help, we certainly can't make much on our farms.

I take great pleasure in introducing Burton W. Potter, Esq., of Worcester, who will speak on "The farm help problem."

Mr. Potter. I think I have a very hard subject to handle, and I haven't prepared what might be called an economic address, padded with figures and phrases that are familiar to every student of political economy. It is a practical subject, and I have tried to treat it in a practical way, and to make some suggestions that we all would be able to follow, in some measure at least, if we desired to do so.

# THE FARM HELP PROBLEM.

BY BURTON W. POTTER, ESQ., WORCESTER, MASS.

The scarcity of farm help during the past decade has seriously affected the agricultural interest of this State. During that time it has been no unusual occurrence for a farmer to quit his business because he could not hire competent help at the wages he could afford to pay. This state of affairs has injured our agriculture. Sometimes when a farmer gives up and moves away, his homestead becomes an abandoned farm; and if he continues to live upon his farm, but engages in other business, it becomes an uncultivated farm, and deteriorates rapidly in value and fertility.

The scarcity of farm help also affects farming disastrously in other ways. It retards farm improvements. The farmer who finds it difficult to do his ordinary farm work with the help at his command, is not likely to undertake the job of cleaning his rough land of brush and stone. Drainage is postponed. Brush cutting in the pasture and around the fences is neglected. The buildings are not painted or repaired. Grain raising is curtailed. The horses and cattle are neglected. The ability to raise good calves, lambs and colts is becoming a lost art. The swine industry is waning. The farmer is becoming tired and discouraged. And this state of affairs is attributed in large measure to the scarcity of efficient farm help. But it may be said you are begging the question, as you have not shown that there is any scarcity of farm help. I think it is a self-evident proposition to every farmer who has been dependent the past few years upon hired help. He knows that it has been impossible to secure capable and intelligent help at any price. There being few native Americans in the farm help market, he has been obliged to employ foreigners, who are unfamiliar with our methods of farming and who cannot speak our language very well, if at all. While this class of employees is well meaning in the main, and to them we owe a debt of gratitude, for without them we should have been devoid of help, — yet it has necessitated the constant presence and direction of the employer. They cannot be trusted alone, not because they are lazy or dishonest, but because they cannot understand instruction in our language, and do not know how to do our work judiciously without personal direction and supervision. With many of them cleanliness is not considered a cardinal virtue, so their employers in the house and in the field are subjected to continual annoyance and inconvenience that would not be incident to a superior class of help. Yet the scarcity of help has compelled the farmer not only to put up with such inferior labor, but to pay a high price for it.

This condition of things has gone on from year to year until it has become a menace to the agriculture of the State. It is surely a grave problem, and one that is closely bound up with the whole farming problem. What caused it is easy of demonstration. The cheap land and mild climate of the southern and Pacific States, and the fertile soil and brilliant agricultural prospects of the great west and Canada have induced many of our young farmers to try their fortunes there. The wonderful discoveries in the application of electricity to the varied developments of human industry have called our young men and women from the farm to service in the electric car, the automobile and the telephone office. The unparalleled development in this country of every kind of industry known to modern civilization has furnished employment for thousands of our young people at higher wages than our farmers could afford to pay. The centralization of population, which is a marked characteristic of this age, has multiplied the inhabitants of towns and cities and lessened the help upon the farm.

Another potent cause for scarcity of farm help is the lack of children upon the farm. Our farmers are as guilty of race suicide as any other class of our population. While the farmer is about the only person in these times who can make his children pay their way with profit to him and advantage to them, yet it is a lamentable fact that many young farmers are found nowadays carrying on farms with the aid of few children and sometimes with none.

These are the apparent causes for the scarcity of farm help; but the real cause, after all, is found in the unprosperous condition of our agriculture. The law of demand and supply is as potent in agricultural life as in any other department of human industry. Legislation may modify and retard the operation of this law, but this natural law is more powerful and far-reaching than any legislative enactment. It is always omnipresent, and we have to reckon with it at every step upon the farm and in the shop. The prosperous business always draws money and labor from the less prosperous business. A prosperous industry is constantly expanding, and can afford to pay and does pay higher wages than an unprosperous industry can afford to pay or does pay. Labor goes where it is best paid, and consequently the farm help seek employment in the industries that pay higher wages than the farmers do. Perhaps laborers are foolish to quit the country, with all its health and beauty, for employment in dirty and crowded factories or in the turmoil of the marts of trade; but we must acknowledge that they do it, and that they do it in search of higher wages.

When Prof. L. H. Bailey of Cornell University found that one hundred and fifty-five pupils in that institution, who had been brought up on farms, intended to take up their life work in other occupations, he asked them why they proposed to leave the farm. Sixty-two answered that they had left it because farming does not pay; fifty-four answered that they had left it to escape too many hours of hard work each day; and twenty-six answered that they had left it for its lack of social advantages. Very likely some of these young men will find out when they come to earn a living away from the farm that there are long hours, hard work and lack of social advantages in other occupations and will be glad to return to farming; but we must admit that these opinions of young people are influencing them to leave the farm for work elsewhere.

These causes account for the scarcity of farm help. Now, what is the remedy? Usually it does no good to talk of evils unless we are prepared to suggest a remedy therefor.

In the first place, there is a scarcity of help, or has been, in all branches of industry; and when the rush of business that has prevailed for the past few years is retarded, labor will be in less demand and it will be easier then to secure farm help. But the permanent causes that produce a scarcity of farm help should be removed, and then the farm help problem will be solved. Then, let us consider some of the remedies best calculated to cure the evils complained of.

The more attractive life is made upon the farm, the easier it becomes to find help to live there. Among the things necessary to make farm life attractive to the help are plenty of good food and comfortable sleeping rooms. If there is not enough to eat, and the sleeping rooms are cold, unfurnished attics or dirty rooms over the woodshed, the help will shift to another place in a short time. The untidy, lazy and ignorant will frequently remain for a long time under these conditions; but the help worth having will move on right away. A merciful man is merciful to his beast; and a merciful farmer should be merciful to his hired help. He should not lodge them in stuffy rooms, or require them to sleep on dirty beds infested with microbes and bedbugs.

There is an occasional complaint on the part of farm help that they are not treated well socially; but from my experience as a hired man in early life and from my observation in later years there is not much ground for this complaint. A farming community is proverbially democratic, and the respectable and intelligent farm help are on an equality with their employers. They are usually allowed to sit at the farmer's table; they work side by side with him and his family; they are welcomed at church and the town hall, and they associate with the land owners of the neighborhood in the grange circle and the farmer's club.

But I think there is just ground for the complaint that farm help are often required to work too many hours per day. Under present rural conditions it is difficult to carry on a farm successfully with less than ten hours' work each week day; but ten hours' work is enough, and the farmer who insists upon working his help more than that is contributing to the scarcity of farm help and its degradation. When a person at night is too tired to read or to think, and drops immediately into senseless slumber, he is unfit on election day to perform the duties of a good citizen or on other days to perform the duties of a good householder. The farm laborer is justly entitled each day to a few hours for recreation and attention to his domestic affairs. It may be said that he would not spend this time profitably if he had a chance to do so; but he has the right to the opportunity, and history shows that he has generally improved the opportunity when given the chance.

When the Agricultural Laborer's Union of England, under the leadership of Joseph Arch, secured shorter days' work for themselves, they soon became more intelligent and better householders. Their gardens were better cultivated; their tenements were better furnished. Flowers began to blossom around their cottage walls, the windows were neatly curtained, books and papers appeared on their tables, and everything inside and outside their dwellings indicated a marked improvement in their social condition. And in this connection another remedy for the scarcity of farm help could be found by the adoption here of the English system of cottages for the farm help. There it is customary for the farmer to have cottages upon his farm for the use of his help. This secures him permanent married help. The male employees work in the field, and their wives and daughters, being near by, are frequently employed in the farmer's house. A garden goes with each cottage, and long service on the same farm is not an unusual occurrence.

In the report of the meeting of last year of the Lincoln Agricultural Society in England, where prizes were offered to farm and domestic servants for long servitude, there were eleven competitors in the class for working agricultural foremen who had the longest record of service in one family or their predecessors. William Brighton won the first prize, with a record of fifty years' service; and three others won second, third and fourth prizes, with records of thirty-eight, thirty-six and thirty-five years respectively. The class for shepherds was won by four men who had served one employer for forty-seven, forty-one, thirty-eight and one-half and thirty-five years respectively. In the class for married men or widowers for long service there were nineteen competitors, and the prizes were won by five men, who had served respectively for fifty-four, fifty-three, fifty-one and one-half, fifty and forty-eight years. I have never known of agriculture being encouraged in this country by the offering and awarding of such prizes, but no doubt prizes of this sort would do as much for agriculture as many of the prizes that are offered at our agricultural fairs.

The use of cottages for help serves another good purpose. It allows the farmer's family to live privately by themselves, and it lessens the labor of the feminine members of the family. There is no more reason why the farmer's wife should cook, wash and mend for the laborers on the farm than there is for the merchant's wife to board and darn for the clerks in the merchant's store. Of course the good farmer's wife, like the good merchant's wife, is willing to board the help when necessary, and many a one has in this way lent a helping hand in building up her husband's fortune; but when necessity does not demand the boarding of the help in her home, she should be relieved of this burden and allowed to look after the welfare of only her own household.

There are two other ways to solve the farm help problem: one way is for the farmers to transact their business with as little help as possible; and the other way is for them to induce laborers to enter into and remain in their service in preference to other employment. Now, farmers can easily lessen the number of their help by the use of labor-saving machinery. Good machinery wisely used will enable a farmer to dispense with some hired help. True, good machines are expensive, but they are easily housed, and do not go on strike at the least provocation. They do not object to long hours, or ask for a day off every little while to visit the city or village. They lighten the labor of their owner by doing his hardest and most disagreeable work. They make farming a more pleasant and scientific occupation than it was formerly. Every farmer should provide himself with a full quota of such help. The hand-labor system has had its day, but it should now make way for the machinery system. In these times farming can be made profitable and certain as an industry only by the judicious use of the best and the most improved farm machinery.

Another way to get rid of hiring help is to undertake to do no more than we can do ourselves. This method has been adopted by many farmers, but it has worked disastrously to agriculture. A farmer with a few children can often manage successfully a small farm without hired help; but the children are used to some extent in lieu of the hired help, and they furnish no argument for the nonemployment of help. No farm is small enough for one man alone to run profitably. Two or more persons can work together to the best advantage in many kinds of farm work. It is good economy to employ as much help as can work to the best advantage in any kind of business. To do less is to be penny wise and pound foolish. Hence the nonemployment of necessary help is not a satisfactory solution of the farm help problem. But it is legitimate and often wise for a farmer, when hampered and tormented by the scarcity of help, to change his methods in a way to reduce the number of his employees. As less help is required to raise live stock for meat products than for dairying or grain raising, it might be advisable for a farmer with suitable land to engage in meat production rather than in grain and dairy production. The present price of meat is high, and it is likely to remain high, and consequently it might be well for many farmers to raise sheep and cattle for meat production. By doing this, many a farmer might diminish his help without any diminution of his income or of the fertility of his soil. The poultry and fruit industries also furnish promising fields for work without a great number of help.

Again, the scarcity of farm help could be lessened by the payment of the same wages and the employment of the same number of men all the year round. It is now the custom of most farmers to employ more help and pay them more wages in the summer than in the winter. This is not customary in most other kinds of business, and for this reason help prefer employment where they can earn the same wages at all seasons of the year. Then, too, when help are thrown out of employment on the farm in the fall and are compelled to seek work elsewhere they are quite likely not to present themselves for employment on the farm the next spring. Farmers should change their methods in this respect. The help are obliged to incur the same expenses in winter as in summer, and to give their time in one season the same as in the other, and there is no good reason why they should not have the same pay throughout the year. By the adoption of diversified farming and the proper rotation of crops it is feasible and not financially detrimental for the farmer to employ his help at the same wages throughout the entire year. If the farmers generally would plan to do this, they would find it easier to get good help and help that would be more likely to remain with them from year to year.

Then, again, much could be done to relieve the scarcity of farm help by the proper education of the farmer's children. Until recently it was thought by most people that educated youth should seek a vocation outside the farm. It rarely happened, but when a college-bred young man remained upon the farm his action was regarded as an evidence of his lack of ambition and aspiration for the best sphere of work. This public belief has operated in the past and is operating now to depopulate the farms of educated young people. Then, too, we have believed so ardently in the value of education that we have kept our children constantly in school to the age of maturity, and thereby deprived them of learning the details of farm work. The farmers of England declare that unless children learn the details of farm work and the management of animals before they are fourteen, they never learn them at all. They say that when the practice of youth is neglected, the theory of later years is expounded in vain. This belief actuates people who favor the teaching of agriculture in our public schools to insist upon having such teaching begin when the pupils are young. The teaching of agriculture in the public schools has been of great use in the development of rural happiness and prosperity in Holland

and other European countries. Such teaching has been begun in this country, and it will surely spread until its beneficent influence reaches every nook and corner of the land. College-bred people are no longer ashamed to be known as farmers. When farming becomes popular and profitable, the children of farmers will be content to continue in the vocation of their parents, and then the farm help problem will be solved.

There is one other circumstance that will help to keep laborers upon the farm, — when they realize that the difference between farm wages and factory wages is not so great as it seems to be. There are no trade unions among farm laborers, and an extensive strike for higher wages among them was never heard of. The reason for this is found in the fact that the farm laborer is not affected, as is the laborer in other occupations, by the high cost of living. The mechanic or industrial laborer is immediately affected by an increase in the cost of living. He discovers at once that his wages are insufficient to support himself and his family, and his only refuge seems to be a strike for higher wages. Farm help are not affected in this way. They board at the farmer's table and room in the farmhouse, and therefore they are not specially concerned about the price of milk or the other necessaries of life. For this reason the wages of farm help are really higher than they seem to be, and often higher in reality than are paid to laborers in other pursuits. The fair way to judge of the relative wages of employees is to find out the surplus left at the end of the employment. The farm hand who is " found " as a part of his compensation usually is able to lay away more of his wages than the laborer who " finds " himself, though his wages " sound " more in dollars and cents. And another thing to be considered is, that employment on the farm is more secure and permanent in hard times than employment in other occupations. In such times, when industrial laborers are being thrown out of work by the thousands, the good farm hand has nothing to fear unless it be a reduction of wages, for his services on the farm are needed in hard times as much as in good times.

I have said that the real cause of the scarcity of farm help is the unprosperous condition of our agriculture, and I will now say, by a parity of reasoning, that the real remedy of the evil will be found in a prosperous agriculture. When our agriculture becomes so prosperous that it will be popular as a business, and will pay its employees as high wages as any other industry pays, then there will be no scarcity of farm help. We all like to be optimistic rather than pessimistic in our views of agriculture, and therefore we have tried to make ourselves believe that our farmers are prosperous. If our agriculture was really prosperous, every well-conducted farm in the State would return a fair profit on its value. Does it? Undoubtedly many of our farms that are favorably situated near large towns and cities, where fruit and garden truck are raised, do bring in a fair profit on their value; but a great majority of the well-managed farms of the eastern States do not return a fair profit on their value. This shows that the agricultural conditions here should be improved. Some of the unfavorable conditions are natural and some of them are artificial. Our small fields and rocky hillsides have not been able in the past to compete successfully in grain and live stock raising with the large fields and fertile soil of the west, but these unequal conditions are growing more equal every year. The fertility of the western land is being gradually worked out of it. The western farmer can no longer pasture his cattle free of charge on government land. He now has to raise his grain and feed his stock on high-priced land, and consequently the eastern farmer is able to compete with him on more equal terms than formerly. The time is coming when beef, mutton and pork can be produced in New England as cheaply as in the west. The unfavorable natural conditions of the east are slowly growing better. The unfavorable artificial conditions handicap the eastern farmers, but the remedy is in their own hands. They must lower the freight charges for short hauls on our railroads. They must cease to produce nothing but milk on their farms. They must see to it that the tariff laws and the laws of taxation give them an equal chance with other industries.

They must not permit themselves to be longer exploited by middlemen, but should sell the products of their farms directly to the consumers, either individually or through co-operative associations.

In 1869 General Butler, in an address before the Worcester Agricultural Society, said: "No association of men have ever undertaken to aggregate their capital for the purpose of increasing the profits of agriculture. No act of incorporation was ever asked or granted by the Legislature to raise corn, or wheat, or potatoes. Therefore it is, that, while every other human pursuit has been aided by association and very largely by legislation, nothing has been or can be done by law specifically to aid the farmer, or generally, except to protect him, his property, his earnings and his rights."

Since then the farmers of Massachusetts have availed themselves of the advantages of association by the establishment of co-operative creameries and cheese factories, of neighborhood telephones and milk-producing associations.

There is a corporation at Greenfield dealing in sheep and cattle; there is a corporation at Leominster that is raising and selling seed potatoes; another at Montello engaged in breeding pure-blooded cattle; and also a successful farmers' mutual fire insurance company. There is a movement on foot to form cow-testing associations among the dairymen of the State, and another for the production and distribution of agricultural products. We should imitate the agricultural and legislative methods of the wise and thrifty Danes, who are now leading the world in progressive and profitable agriculture. They have learned the necessity and the value of co-operation, and conduct their agricultural affairs on co-operative principles.

When our agricultural conditions here have been improved to such a degree that every well-conducted farm will return a fair profit on its value, then people will abandon other pursuits to engage in farming, and laborers will seek employment on farms in preference to employment elsewhere; and then our "farm help problem" of to-day will be ancient history.

Mr. F. A. Bliss (of Rehoboth). I claim that there is no one thing that damages us more in this labor question than the drink habit. Does the lecturer know of any remedy?

Mr. Potter. That is a question that has been asked for a great many years, and nobody has ever been able to solve it. There is no question in my own mind but that the sale of intoxicating liquor is the greatest curse in the country, but it is a hard matter to handle.

Question. Have you knowledge of agencies which supply Italian labor for farms, and have you had opportunities to observe the record the Italians have made?

Mr. Potter. I never have employed Italians on the farm. I have had them for other work and they worked very industriously. We had no trouble with drinking, or anything of that sort. I hear some of them are especially good for garden business.

Mr. C. W. Mann (of Methuen). I have had a good deal of experience with Italians the last fifteen years. My business has been farming, but not altogether. I have been some years in outside work, and my acquaintance with Italian laborers began, as one of the commissioners, with putting in town water works. I used the same help on my farm, as far as I could, in clearing and reclaiming land and clearing out walls, and such work. At times I have had from twenty to fifty Italians for a few days. The ordinary Italian is an honest, faithful laborer, and will do more hard work with the pick and shovel in a month than almost any man you can hire for that work. If you want him to drive a horse, sometimes he can turn round with it, if it is a two-wheeled cart. In the last fifteen years I have employed perhaps a thousand different Italians. I have known them by name and talked with them to some extent in their own language, because you cannot handle them to the best advantage unless you get a little acquainted with them. But among that thousand I had one who was a good teamster; he would drive a team as well as any American I have seen. With this exception, I have never seen one you could trust away from your sight and away from another driver. The only way I could use one was to have two teams, one with an American driver who understood it, and the other could follow him around.

But as for doing any ordinary farm work, the same as you tell a hired man, "Here, John, you go out and do that job to-morrow, while I am away," and expect to come home and see it just as you wanted it, — well, if you know how to tell an Italian how to do that, he will do it, but if you don't, you will find your parsnips banked up, instead of the celery. They will do the work, but will do the wrong thing, perhaps; and generally when you think they understand you they don't, but they always say, "Yes, yes," and will go to work and do something, and ten to one it is just the opposite of what you told them. If you tell them to pile something up here, they will go and pile it up just the other side, where you don't want it; and a good deal of it is because of the difference in the languages. In our language we put the horse in front of the cart, but in their language it is the other way, — the cart is in front of the horse; and until we get some little idea of their language and customs and manner, there are apt to be misunderstandings. If you want to send a man out to cut down a tree, you don't want to send an Italian, because the only safe place for an Italian with an axe is on a muck meadow. But for drainage or digging stone or trucking stone, or laying stone, any rough farm work of that kind, that you can't stop to do yourself or have your more intelligent help do, you can pick up a gang of them, you can put them in a house on your place, if you have one, or a shanty, or if you haven't, they will build one themselves with a few boards and a little old tin, and a cook stove, and they will do any kind of work; and it is the only way I know of, with the present condition of labor. If I wanted one of them to run a mowing machine for me, or wanted him to run a horse-power on the farm, he couldn't do that. You can't expect anything of them any more than you would expect of a team; but they will do what they do know nicely and faithfully, and when you find one that won't, you can do as you would with any other man, let him go, — unless he has a brother who is very good, and you have to keep the two to keep the good one. I have often had that worked on me:

a man I felt I couldn't spare would come up with some second-class brother or cousin, and I would have to give him a job, or lose the good one, — like city politics. One big fellow, six feet tall, and weighing about two hundred, a first-rate workman, had a little, insignificant brother whom I never liked the looks of; he demanded a place for him, and I let them go. Well, they got a place together, and the last I heard of him he had used a knife as he ought not to, and had to get out. I never have had that trouble, although one day one of them, who had been eating an apple and using his knife, hit another fellow in the cheek with it. He didn't mean to, and ran two miles to tell me, because he was afraid they would be after him. I kept him in a different gang for a few days, and the matter blew over, and they were two of the best men I ever had. One of them worked for me six or seven years, and when he went home he drew out a thousand dollars to take with him. Instead of standing over them with a whip, help them along and show them how; but don't ever try to show an Italian how to build a fire. I was clearing up a lot of wood one time, and had a lot of green brush to burn. I tried to show them how to make a success of it, and they went at it and showed me how. It is really a difficult thing to take a lot of green brush and burn it clean, and they will do it every time.

The conditions that govern the lecturer are entirely different with me in my location, and so is it with all. I judge his business is largely dairying, while I keep but one cow. Perhaps a man with a lot of cattle can keep the same help all the year round, or a greenhouse man; but the ordinary farmer, who raises his hay and garden crops, more of a farm garden than a market garden, can't keep the same help the year round. At times in the summer I have anywhere from fifty to a hundred in the morning, picking berries. I can't keep those more than a few hours for a few days. In the weed season I may have twenty men for a little while; in the winter I have no use for them. We have to go to the city and pick up what we can find.

Mr. AUGUSTUS PRATT (of North Middleborough). I have been very much interested in this lecture. There were some hints thrown out which I think it wise for us to adopt. For instance, he spoke of not requiring our help to work over ten hours. Now, where our factories work their help eight hours or nine hours, how can we farmers expect our hired men to work twelve or fifteen hours, or twelve hours, even? I don't want any of my men to work over ten hours under any conditions whatever. I want it planned so ten hours of faithful labor covers the whole time I expect of them.

Then there is another point, — that we should have houses where we could make homes for them, where they could raise their families, for that makes a man interested in your business. Where he considers he is located, and going to stay with you, he is interested to help your farming along. I know that by experience. I have a man that has worked for me up to last year seventeen years, and he lived in my house, and he was interested in the family and my business. He was interested to have things go along well, and when another man came there to work he was interested to get a fair day's work from him.

And then there is another thing, — prompt payment should be considered. Any man that works six days for me, at the close of Saturday night I want that man to have his money; whether he has worked the full week or not, I mean to square up with him, and not owe him a day after Saturday night. That gives him an opportunity to spend his money, or put it in the bank, or do what he pleases; and I think he is better satisfied if he can have his pay promptly, and knows he is to have it then, so he can arrange his affairs and pay his bills at the close of the week.

Another point the lecturer brought out very clearly, — that in this scarcity of labor we should do all we possibly can with farm implements, machinery, new inventions, wherever we find those that are good. I haven't used a sulky plow until this last season. I thought it was more of a lazy man's machine than a good farmer's; but I find I am ashamed of myself to say that I didn't have it twenty years ago, for it does better and more rapid work. But other implements I have seen fit to take, the manure spreader and many others of the improved implements, as they came along. I consider it is money well invested. I think we should do all we possibly can with machinery.

I think that it is wise for us to treat our help well in all cases. I believe that if you agree to pay a man so much per week, or per year, or per month, whatever time you hire him for, it is better for you to pay him a little more than is due any time, than to show any disposition to dock him. I have always found it to my advantage, if I have a fair stock of potatoes or vegetables of any kind, or milk, or anything, to once in a while make a man a present of some one of these products of the farm. It encourages him; he feels as though you had an interest in him; and I have found it profitable to do that.

Another thing, — I believe it is better to pay pretty good wages. In our gypsy moth work, where we employed from two to three or four hundred men a day, we found it a great deal more satisfactory where we had a good man. The work that a good man did we called a great deal more profitable to the State than some cheap help; and I think it is so in every case, — that a farmer can get better work by paying a good, fair price, and having your man interested in your farm work. You will gain rather than lose, for I believe you will lose if you hire cheap help. I don't believe in what I just heard the gentleman say about the Italian help here. I don't believe it is help I want on my farm. I believe I would rather pay a higher price for my help than to expect, when I have told a man to do thus and so, to go home and find it done just the opposite, in some other way. I would rather have a man do what I told him to do, and I believe we have help that will do that; and I believe if we use them well they will use us well.

How to make the help more plenty, I don't know. I am located in a manufacturing town, where the men can go into a shoe factory and make three, four and in some cases five dollars a day; but then, to offset all this, for days they are out of the factory, the factory is running only six hours or seven hours, the factory is not running full time, shut down to take account of stock, or to wait for orders, and those men are standing idle. They don't in the end save much more money than the man working on the farm at a less price.

Mr. H. G. WORTH (of Nantucket). Perhaps I can add a trifle in regard to Italian labor. I have had in my employ several hundred Italians for railroad construction. The Italians, like people of other nationalities, vary very much. I find that the southern Italians in coming to this country are unused to working; they are small men, and very poorly fed, and it takes them some time to learn how to use a pick and shovel; whereas the Italians coming from the north of Italy, as a rule, are pretty well up in ordinary operations such as I was engaged in, about as they would be in farming; they are larger men, stronger men, and do much more, and I think every one of them would be equal to one and a half or two of the Neapolitans. I think the Italian laborer equal to the German, the Swiss, the Irishman or the Dutchman. Of course he cannot speak the language, but I consider him as good and agreeable as any other.

Mr. AUSTIN. I had some twelve years' experience with the Italians, as many as one hundred and fifty at a time, and I agree with the former speaker in regard to them. If you can get the north of Italy Italians, they are all right. The most of mine came from Lombardy, and I found they knew a great deal about farming, although they were not much for teamsters. They were the best men that I ever had for caring for stock, and for grubbing, opening up a piece of land, or anything of that sort, they had no equal. I had these men for twelve years, and in that way I became quite familiar with their language, so I obviated in a great measure the trouble of having them do directly the opposite of what I wanted them to do. But if you get the class of Italians that land here in large numbers from Naples, you will get a very inferior set of men. They are the ones that go round with a hand organ, trying to get a living with the least possible work. But my experience with Italian labor has been very satisfactory indeed, and I would advise any one who can get a good Italian from the north of Italy, to get him, and I believe as soon as you can make him understand what you want, you will be perfectly satisfied with his labor. He is one of the most conscientious laborers we have; and, although when they arrive they are a suspicious class of people, as soon as you win their confidence they trust you implicitly.

I remember the last I had I had a year, and when they left I was owing them each $360, so it shows what confidence they will have in you after they become acquainted with you.

Professor Shaw. I was greatly interested in the paper given by Mr. Potter, which I think was ably handled. The same difficulties confront us in the west, but I think to a less extent than with you people here in Massachusetts. Labor probably is not quite so scarce with us as it is with you, but it is difficult to get enough of labor; in fact, it is so difficult that a good many farmers who are grain growers are trying to do without labor almost altogether, and to do their work themselves by the aid of such machinery as they can introduce.

There was one point that he raised, that I think is one of great importance, and probably does more than almost anything else to drive the right class of labor away from the farm, and that is, employing the laborer for six to eight months in the year and allowing him to go idle during the remaining portion of the year. It isn't fair to expect any class of men to spend their time in working for us six to eight months of the year and going idle the other four. There may be some callings that necessitate that to a certain extent, and I think fruit growing has been mentioned as one; but isn't it a possible thing to combine fruit growing and dairying, or to combine two interests, so that the man who comes to work on the farm, or to engage in agriculture, will have employment for twelve months instead of eight? Let us remember this difficulty; and I think it must be remedied before the labor question will be upon a proper basis.

In one respect the labor problem is worse in the west than here. One-half the State of Minnesota, and I might say all of North and South Dakota, are devoted entirely to the growing of grain; and the men who do that only are occupied only four or five months of the year, and employ hired help only during that time, and the rest of the year don't hire help or do any kind of farming. They get the railroads to bring men in by the thousands, I might say tens of thousands. They help reap the grain, and then their farming is done.

Secretary Ellsworth. I think farmers furnishing cheap cottages on their farms for men with families would go a long way towards solving this problem. There are thousands of young men in cities working in stores who are discouraged because they are not any more than getting a living, and they and their families would be much better off out on a farm.

The Italian laborer has been talked about. I know something about him, and my experience has been something like Mr. Worth's. I have found some of them almost indispensable. They will do the rough, hard work, and more of it, and are glad to do it. Of course you need a foreman to watch out and see that they do their work right. I want to ask the lecturer if he doesn't think it an advantage for the farming community to put up rude sheds, and ask the Italians to come and occupy them? They will come, for they like to get in together; where a number of them can get into one of these little rude buildings, they will stay with you, and they will do a whole lot of hard work, providing you have a good foreman to lead off, or lead them yourself. Don't you think it is a wise thing to get the Italian labor out into the country? The fertility of our soil is not exhausted; it needs work; it needs plowing; it needs harrowing; it needs fertilizing.

Mr. Potter. I like to see things around the farm look artistic and beautiful, and shouldn't like to see a lot of old shanties put up that would mar the looks of the place. But if you can find some place to locate them, I think it might be a good thing.

Prof. Wm. P. Brooks (of Amherst). I happen to know one successful market gardener whose practice, I think, illustrates exactly what is necessary to solve the farm help problem. It is, of course, fundamentally necessary that the business be profitable, so that the farmer may afford to pay good wages. This man employs perhaps thirty or forty men in the summer, and perhaps from twelve to sixteen in the winter, and keeps usually about twelve working horses. He provides cottages for the men he keeps the year round, and when one of them has been with him a good while, and expresses a desire to get married, wanting a family life, he allows him to put up a house himself and pay for it himself on the farm. He pays good wages; he doesn't give them an easy time; he isn't inefficient in any way; he is capable of knocking a man down who goes to him with any insulting words, as I know he has done within a year or two, with a single blow from the shoulder; and he has eleven hours as a day's work, which is common, I think, among the market gardeners in this vicinity. But his foreman has been with him more than twenty years, as I know; and he has another man in his employ who has been with him I don't know how long, who never collects much money, but who allows his employer to put it into the bank for him, and I wouldn't venture to say how many thousand dollars he has laid up there. Now, this man keeps these men because he treats them fairly and generously, manages them efficiently and pays them good wages; and if he has an exceptionally profitable year he pays them something extra, — lets them share in the profits. He gives his permanent men turkeys Thanksgiving and Christmas. As for this man who has been in his employ so long, a native of Ireland, he said to him a year ago this time: "Now, Mike, you have lived with me a long time; you have an old father and mother and relatives in Ireland; wouldn't you like to go home and stay through the winter? If you do, I will pay your passage." And the man said he didn't want to go. He trusts this man, — that is another thing, — he makes him responsible for certain things. To illustrate how this man looks at it, he trusts him with looking after the celery he raises, perhaps thirty acres, I think, and this Irishman is responsible for the ventilation and protection from frost, and so on. This happened within a year or two, that the people were having a dance, and the Irishman had gone; it was a pretty cold night, and the owner along about midnight went out to look at the celery pits, and he thought they needed to be closed up a little more than they were, and so he closed them. The next morning the Irishman said to him: "Didn't you tell me to look after the celery? You moved the ventilators last night; I don't want you to do that." In this way this man has no trouble with farm help.

How to make farming profitable, — that is the keynote to the situation. That isn't a question, of course, which I can settle here. I don't think it will be in competing with Michigan or Minnesota in raising wheat at the present, but the way will appear with fuller knowledge of conditions. Many of our farmers are doing business in a little, pedagogue sort of way. They are trying perhaps to keep their help busy all the year round, and they have a little of this and a little of that, and do not carry on any branch of farming on a scale large enough so it can really be made very profitable. What would you think of a man in these days, who, in the shoe business, should try to work and keep himself busy the year round in a little shop, such as many of you can remember, doing all the work himself, perhaps cobbling for his neighbors in addition? You would know he never would become rich in that line of business. Conditions have changed absolutely. Every farmer of us has got to seek a location offering natural advantages for some branch of farming or gardening or fruit raising, and then, having found a location, or if the location has been selected for him, having studied the situation and found out what the locality is suited for, then go into some specialty intelligently, studying carefully, finding out all there is to know about it, and then organizing in such a way as to do the business on a considerable scale. On these lines farming can be made much more profitable than it is under present conditions.

I don't fully agree as to the impossibility of our raising grain or making meat. I think it could be done. I know we can purchase land with buildings in many cases at prices which will make it possible to carry on even the lines of business which have been referred to with a fair degree of profit. The price of the land here, plus the cost of all the improvements necessary to make it possible to do the business on a large scale, according to lines Professor Sanborn is advocating, — the original cost plus the cost of getting out the rocks and stumps and burying the stone walls, and drainage, etc., — will not equal the cost of land in the west. And other conditions than simply the natural fertility in the soil determine the possible profits. Climate is an important feature, and we have a better climate here than in the west. The rainfall along any latitude increases steadily from the Atlantic seaboard westerly; and I have the testimony of no less prominent a man than Professor Smith of the Experiment Station in Michigan, who visited Amherst just about a year ago this time, that our corn fields are superior, much superior, he said, to anything that he had seen in Michigan. It is a mistake to believe that our soils are exceptionally poor. Our soils are strong, and they can be cleared and fitted for work by machinery upon a large scale at a cost which will make the business profitable.

I do not believe, however, as I said a moment before, that we shall engage in raising wheat or even oats in most sections to any great extent; for we have to consider, as every party does, what is profitable, and in most localities some other line probably will be more profitable than grain raising or meat production.

The speaker expressed the idea that we ought to raise our grain; but it is a question for every farmer, who has a certain amount of land and a certain amount of labor, to settle for himself, — Shall I raise grain, or had I better raise potatoes? And he will decide the question upon the basis of his judgment as to which will give him the most profit, and I believe in the majority of instances it will be the potatoes, certainly, rather than wheat or oats.

Massachusetts farming has been discouraging to many, no doubt, and no doubt will be in the future; but along the line of a more careful study of conditions and in the adaptation of the business to the location I believe there is an opportunity for as great a profit in agriculture here as in any section of the country. And I not only believe it, I know it, because I know men all over the State who are making the business extremely profitable.

Mr. W. W. RAWSON (of Arlington). The subject of farm help is something that has been troubling a great many for the last few years, although it has never troubled me. But I have gone at it in rather a systematic way, perhaps, to remedy the trouble; that is, keeping nearly all my help the year round, furnishing houses for them to live in near the place or on the place. I have sufficient houses to keep all of them, if I wanted to, for I have over fifty houses, although I haven't over fifty men at the present time; still, about fifteen live in my houses. The men who live in those houses, many of them, have at the present time houses of their own. They have bought land and I have loaned them money to build a house, they have built the house and brought up a family, paid for the house and own it themselves, and live in it with their family, and work for me. I have had some twenty or thirty men who have been with me from fifteen to thirty-five years, and those men never ask me what they are going to get, or what I am going to pay them, at all. I hired forty-five men last Saturday night, and only five of them asked me what I was going to give them for this winter; didn't say a word about it to me; and they haven't for years. So, of course, you have got to get the confidence of your men. Not long ago I valued the estate of one man who worked for me thirty-nine years, and he left ten thousand dollars clear, three good houses, two tenements each. He had saved that amount of money, and brought up five children, — an economical kind of man, couldn't read or write; he could count his money all right, when he got it, but couldn't tell anything about the figures at all.

I pay my men once a month. Now, I don't believe in paying them once a week, at all. The class of men I hire are mostly Irishmen, and they do like their beer and drink; and the oftener you pay them, the oftener they will drink, and if a man won't work for me and take his pay once a month, he can't work for me. And those who work for me say it is a good deal better. "I pay my rent, and if I have a little bill, I go and pay it, and if I have got anything left, I have got it." Getting paid Saturday night is apt to interfere with Monday's work, and Monday is my biggest day the year round, and for that reason I want my help all there. Of course last Monday I didn't have quite all of them; being the end of the month, you know, some of them felt a little good on Sunday, and they weren't all around on Monday; perhaps two or three were missing, but of course out of forty or fifty you wouldn't mind that much. I have some in New Hampshire. I started a little farming up there, six farms together, three hundred and fifty acres, a few years ago, and am trying to see what I can do. I am keeping a couple of thousand hogs, and perhaps can get the place so I can raise something by and by. And up there I have more trouble with help than down here, because they don't want to go so far away from the city. I have more trouble than I do with all the help here, and I have fifteen up there and lots of times I have a hundred here.

The question of pay on the farm isn't to be considered, because the more wages you have to pay on the farm, the more you are going to get for your goods. That will regulate itself. Of course when pay does go up, as it has the last four or five years, — mine has gone up ten dollars a month, — I get more out of it, because these fellows all have the money to spend to buy my goods. We don't realize it, but the time I did the best was when we were paying from fifty-two dollars to fifty-five dollars a month to our men. That was right after the war.

This Italian business, — they are the only help we can get. The Irish used to be the best we could get, and I would rather pay fifty dollars a month to an Irishman now than pay an Italian thirty-five dollars. He is worth it, too, because he won't steal so much. Talk about burning up brush, you don't have to burn it; down our way the Italians would lug it off, so you wouldn't have to burn it, as they do any stuff they find lying around. They will do away with anything they can get their hands on, and consider it theirs. They haven't had any scruples that way at all, never were brought up to do differently, so I suppose they can't help it. I think, however, that the Italian help will be the help of the future, because they are working into our line of business and on the farms. Some of the largest sales that I make in seeds in a year I make to Italians. The last few years I have sold some Italians as high as five to six hundred dollars worth of seeds. You know that means something. They are going to be the farmers of the future, a hundred years hence; when we are raising beef here, they will be the farmers to do it.

Secretary ELLSWORTH. Mr. Chairman, I rise to make a motion, which is a very pleasant duty to perform. I wish to move a vote of thanks to the Massachusetts Horticultural Society for the use of this hall, for their invitation and the many courtesies extended to the Board during this very successful meeting.

The motion was carried unanimously, and at 12.30 o'clock the meeting was adjourned *sine die.*

At 2 o'clock, on invitation previously extended, a number of those in attendance on the meetings made a visit to the Walker-Gordon farm at Charles River and to their laboratory in Boston; also, to the market gardens of Hon. Warren W. Rawson in Arlington.

# ANNUAL MEETING

OF THE

# BOARD OF AGRICULTURE

AT

BOSTON.

JANUARY 7 AND 8, 1908.

# ANNUAL MEETING.

In accordance with the provisions of chapter IV. of the by-laws, the Board met at the office of the secretary, in Boston, on Tuesday, Jan. 7, 1908, at 11 o'clock A.M., it being the Tuesday preceding the second Wednesday of January. The Board was called to order by Second Vice-President AUGUSTUS PRATT.

Present: His Excellency Curtis Guild, Jr., and Messrs. Adams, Allen, Bailey, Bradway, Bursley, Butterfield, Damon, Danforth, A. Ellsworth, J. L. Ellsworth, Gerrett, Howard, Jewett, Kilbourn, Lovett, Mason, Paige, Pease, Peters, Porter, Pratt, Rane, Richardson, Ross, Spooner, Stevens, Tirrell, Ward and Worth.

The executive committee, as committee on credentials, by Mr. Kilbourn, chairman, reported the list of qualified members of the Board for 1908. The newly constituted members are as follows: —

At large, appointed by the Governor, Charles E. Ward of Buckland.

Elected from the —
Deerfield Valley Society, Wm. B. Avery of Charlemont.
Essex, Frederick A. Russell of Methuen.
Highland, Henry S. Pease of Middlefield.
Hillside, Wm. A. Harlow of Cummington.
Middlesex North, George W. Trull of Tewksbury.
Middlesex South, Isaac Damon of Wayland.
Plymouth County, Augustus Pratt of North Middleborough.
Worcester, Burton W. Potter of Worcester.
Worcester County West, John L. Smith of Barre.

*Voted,* That the report of the committee on credentials be accepted and adopted.

The secretary presented and read his annual report, which was accepted.

His Excellency Governor Guild, coming in, briefly addressed the Board along the lines of rural improvements hoped for and expected in the near future, but declined to take the chair, owing to pressure of executive business.

The recommendation in the secretary's report relating to the milk standard was taken up, and on motion was laid over until after the election of officers had taken place.

At 12.40 o'clock a recess was taken to 2 P.M.

The Board was called to order by Mr. Pratt at 2 P.M.

The recommendation in the secretary's report, —

> That the Board instruct its secretary to prepare a bill providing for the establishment of the office of State Ornithologist, to be elected by the State Board of Agriculture, with a reasonable appropriation for expenses and per diem compensation, and to present the same to the Legislature and urge its passage, —

was, on motion of Mr. Jewett, accepted and adopted by unanimous vote.

The recommendation in the secretary's report, —

> That the Board favors all reasonable appropriations for increased efficiency in instruction at the Massachusetts Agricultural College, with particular emphasis upon the necessity of the greenhouse work being properly provided for, —

was, on motion of Mr. Ross, accepted and adopted.

The recommendation in the secretary's report, —

> That the Board take the premium lists of the agricultural societies a little more directly under its control, and that a committee be appointed to consider the make-up of these lists during the coming year, with a view to establishing certain requirements, to which the societies shall be held in future, —

was, on motion of Mr. Spooner, accepted and adopted.

On motion of Mr. Jewett, it was —

*Voted,* That this committee consist of three, to be appointed by the president and secretary.

The committee on experiments and station work, by Mr. Spooner, chairman, presented a written report, which was accepted and adopted.

The committee on Massachusetts Agricultural College, by Mr. Bursley, chairman, presented a written report, which was accepted and adopted.

The State Nursery Inspector, Dr. Henry T. Fernald, presented his sixth annual report, which was read by the secretary and was accepted and adopted.

The committee on domestic animals and sanitation was granted further time in which to report.

The committee on gypsy moth, insects and birds presented a written report, which was read by the secretary and was accepted and adopted.

The committee on forestry, roads and roadside improvements, by Professor Rane, State Forester, presented an oral report, which was accepted.

The committee on agricultural societies, by Mr. Kilbourn, chairman, presented a written report, which was accepted and adopted.

The report of the Dairy Bureau was read by the general agent, Mr. Harwood, and was accepted and adopted.

The twelfth semiannual report of the chief of the Cattle Bureau was presented and read by Dr. Peters, and the report was accepted.

At 5.15 o'clock the Board adjourned to 10 A.M. Wednesday.

## SECOND DAY.

The Board was called to order by Second Vice-President Pratt, at 10 A.M.

Present: Messrs. Adams, Avery, Bailey, Bursley, Butterfield, Damon, Albert Ellsworth, J. L. Ellsworth, Gerrett, Harlow, Howard, Jewett, Kilbourn, Lovett, Mason, Paige, Pease, Potter, Pratt, Rane, Richardson, Russell, Smith, Spooner, Stevens, Taft, Tirrell, Trull, Ward and Worth.

The records of the first day were read and approved.

An abstract of the reports of inspectors of fairs, prepared by direction of the committee on agricultural societies, was read and accepted.

Election of officers being in order, the Chair declared His Excellency Curtis Guild, Jr., president of the Board (by a by-law of the Board the Governor is *ex officio* president).

Further elections by ballot resulted as follows: —

First Vice-President, Mr. Augustus Pratt of North Middleborough.

Second Vice-President, Mr. John Bursley of West Barnstable.

Secretary, Mr. J. Lewis Ellsworth of Worcester.

General Agent of the Dairy Bureau, Mr. Peter M. Harwood of Barre.

State Nursery Inspector, Dr. Henry T. Fernald of Amherst.

Election of specialists being in order, ballots were taken, and the elections resulted as follows: —

Chemist, Dr. C. A. Goessmann of Amherst.[1]
Entomologist, Prof. C. H. Fernald of Amherst.[1]
Botanist, Dr. Geo. E. Stone of Amherst.[1]
Pomologist, Prof. F. C. Sears of Amherst.[1]
Veterinarian, Prof. James B. Paige of Amherst.[1]
Engineer, William Wheeler of Concord.
Ornithologist, Edward Howe Forbush of Wareham.

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[1] Massachusetts Agricultural College.

The secretary appointed his first clerk, Mr. F. H. Fowler, librarian for the ensuing year.

The Chair announced the standing committees as follows (the secretary is, by rule of the Board, a member *ex officio* of each of the standing committees): —

Executive committee: Messrs. W. A. Kilbourn of South Lancaster, John Bursley of West Barnstable, Wm. H. Spooner of Boston, H. G. Worth of Nantucket, Augustus Pratt of North Middleborough, C. D. Richardson of West Brookfield, Edmund Hersey of Hingham, Henry E. Paige of Amherst.

Committee on agricultural societies: Messrs. W. A. Kilbourn of South Lancaster, T. L. Tirrell of South Weymouth, O. E. Bradway of Monson, Albert Ellsworth of Athol, Wm. B. Avery of Charlemont.

Committee on domestic animals and sanitation: Messrs. Henry E. Paige of Amherst, A. M. Stevens of Williamstown, Walter A. Lovett of Oxford, F. A. Russell of Methuen, W. A. Harlow of Cummington.

Committee on gypsy moth, insects and birds: Messrs. Augustus Pratt of North Middleborough, F. A. Russell of Methuen, Noah Sagendorph of Spencer, B. W. Potter of Worcester, Geo. W. Trull of Tewksbury.

Committee on Dairy Bureau and agricultural products: Messrs. C. D. Richardson of West Brookfield, W. C. Jewett of Worcester, Henry E. Paige of Amherst, S. B. Taft of Uxbridge, George O. Millard of Blandford.

Committee on Massachusetts Agricultural College: Messrs. John Bursley of West Barnstable, W. C. Jewett of Worcester, Isaac Damon of Wayland, E. L. Boardman of Sheffield, Frank Gerrett of Greenfield.

Committee on experiments and station work: Messrs. Wm. H. Spooner of Boston, N. I. Bowditch of Framingham, T. L. Tirrell of South Weymouth, J. L. Smith of Barre, Henry S. Pease of Middlefield.

Committee on forestry, roads and roadside improvements: Messrs. H. G. Worth of Nantucket, J. J. Mason of Amesbury, F. Wm. Rane of Boston, Wm. N. Howard of South Easton, H. A. Oakham of Marshfield.

Committee on institutes and public meetings: Messrs. Edmund Hersey of Hingham, Wm. A. Bailey of Northampton, Kenyon L. Butterfield of Amherst, J. F. Adams of West Tisbury, Chas. E. Ward of Buckland, H. M. Howard of West Newton.[1]

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[1] Appointed by His Excellency January 15, as successor to Gen. Francis H. Appleton, resigned.

These appointments were confirmed by vote of the Board.

*Voted,* That the vice-president and secretary be authorized to make necessary changes in list of committees before printing.

On motion of Mr. Jewett, it was —

*Voted,* To approve His Excellency's recommendations on the matter of industrial education, and that the Board will do all in its power to aid in bringing about realization of his ideas.

The Chair appointed Messrs. Spooner, Bursley and Mason as the special committee on premiums of agricultural societies.

The Chair announced the legislative committee as follows: Messrs. Spooner, Jewett, Gerrett, Bailey and Ward. It was then voted to add the chairman and the secretary to the committee.

The special assignment, the question of change in the milk standard, being in order, the matter was taken up and discussed, when it was —

*Voted,* That the Board adopts the recommendations of Secretary Ellsworth that the milk law should be so amended that the winter standard be reduced half of one per cent on the solids, with a corresponding decrease in the fat content required; and that a clause be added allowing the sale of milk under a printed guarantee of fat content, or of fat content and total solids, the same to appear upon each receptacle in which the milk is sold or conveyed.

The committee on agricultural societies, by Mr. Kilbourn, chairman, presented requests for changes of dates for holding fairs; when it was —

*Voted,* That the date for holding the fair of the Blackstone Valley Agricultural Society be changed to the third Tuesday after the first Monday in September; that of the

Bristol County Fair, Inc., to the second Tuesday after the first Monday in September; that of the Hoosac Valley Agricultural Society to the first Thursday after the first Monday in September; that of the Oxford Agricultural Society to the Thursday preceding the first Monday in September; and that of the Worcester County West Agricultural Society to the third Thursday after the first Monday in September.

Mr. Gerrett, from the Franklin County Agricultural Society, extended on behalf of that society an invitation to the Board to hold its next public winter meeting in Greenfield, which invitation was accepted.

The following tribute to the memory of Mr. Reed was presented and unanimously adopted: —

A valued member has passed away since the last annual meeting, in whose memory the Board would record the following: —

Mr. Quincy L. Reed of South Weymouth was the first delegate elected to the Board by the Weymouth Agricultural and Industrial Society, having taken his seat in February, 1891, and he had served continuously and faithfully since that date, — a period of sixteen years. His wide experience, his genial personality, his faithfulness to duty, made him an exceedingly useful member, and the Board in his decease has met with an almost irreparable loss. Mr. Reed had the faculty of making friends to an unusually large degree, and those who were his associates on the Board of Agriculture will always cherish his memory and will not forget his kindly and genial ways.

The Board of Agriculture desires to place this memorial of his worth on record and to extend to his family its sympathy.

*Voted,* That the secretary be given authority to arrange for such summer meetings as he may see fit and funds available will permit.

Mr. G. C. Sevey of Springfield, on invitation, briefly addressed the Board on the subject of forming local cow-testing associations; when it was —

*Voted,* That Mr. Sevey be given a vote of thanks, with the assurance that the Board endorses his proposition.

For a local committee of arrangements to assist the secretary and the committee on institutes and public meetings in providing for the public winter meeting in Greenfield, Messrs. Ward, Avery, Bailey, Paige and Albert Ellsworth were appointed.

Mr. Kilbourn, for the committee on agricultural societies, reported the assignment of inspectors, as follows: —

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| Amesbury and Salisbury, at Amesbury, September 29, 30 and October 1, | G. O. Millard. |
| Barnstable County, at Barnstable, September 1, 2 and 3, | Frank Gerrett. |
| Blackstone Valley, at Uxbridge, September 22 and 23, | N. I. Bowditch. |
| Bristol County, at Taunton, September 15, 16, 17 and 18, | W. A. Kilbourn. |
| Deerfield Valley, at Charlemont, September 17 and 18, | W. A. Lovett. |
| Eastern Hampden, at Palmer, October 9 and 10, | A. Pratt. |
| Essex, at Peabody, September 22, 23 and 24, | A. Ellsworth. |
| Franklin County, at Greenfield, September 23 and 24, | H. S. Pease. |
| Hampshire, at Amherst, September 22, | A. M. Stevens. |
| Hampshire, Franklin and Hampden, at Northampton, October 7 and 8, | E. L. Boardman. |
| Highland, at Middlefield, September 9 and 10, | T. L. Tirrell. |
| Hillside, at Cummington, September 29 and 30, | O. E. Bradway. |
| Hingham, at Hingham, September 29 and 30, | W. H. Spooner. |
| Hoosac Valley, at North Adams, September 10, 11 and 12, | H. E. Paige. |
| Housatonic, at Breat Barrington, September 30 and October 1, | B. W. Potter. |
| Marshfield, at Marshfield, August 26, 27 and 28, | W. A. Harlow. |
| Martha's Vineyard, at West Tisbury, September 1, 2 and 3, | C. E. Ward. |
| Massachusetts Horticultural, at Boston, September 4 and 5 and October 10 and 11, | H. M. Howard. |
| Middlesex North, at Lowell, October 1 and 2, | John Bursley. |
| Middlesex South, at Framingham, September 17 and 18, | H. G. Worth. |
| Nantucket, at Nantucket, August 26 and 27, | W. A. Bailey. |
| Oxford, at Oxford, September 3 and 4, | C. D. Richardson. |
| Plymouth County, at Halifax, September 16 and 17, | John L. Smith. |

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| Spencer, at Spencer, September 24 and 25,[1] | G. W. Trull. |
| Union, at Blandford, September 16 and 17, | J. J. Mason. |
| Weymouth, at South Weymouth, September 24, 25 and 26, | W. C. Jewett. |
| Worcester, at Worcester, September 7, 8, 9 and 10, | W. A. Russell. |
| Worcester East, at Clinton, September 16, 17 and 18, | W. N. Howard. |
| Worcester Northwest, at Athol, September 7 and 8, | Isaac Damon. |
| Worcester South, at Sturbridge, September 17 and 18, | Wm. B. Avery. |
| Worcester County West, at Barre, September 24 and 25, | J. F. Adams. |

The report of the committee was accepted and adopted.

*Voted,* That any unfinished business or new business that may arise be referred to the executive committee, with power to act.

The records of the meeting were read and approved.

The meeting was then dissolved.

J. LEWIS ELLSWORTH,
*Secretary.*

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[1] Later changed to September 22 and 23.

# REPORT OF COMMITTEE ON AGRICULTURAL SOCIETIES.

[Read and accepted at the Annual Meeting, Jan. 7, 1908.]

The committee on agricultural societies found in the reports of the inspectors of the several fairs no mention of gambling and objectionable features, but general commendation of the good order and good management prevailing, and in the larger number of fairs good weather prevailed, and good attendance assured a financial success; while those fairs held on Labor Day and the early days of September were not so fortunate, and the continued rains made the days gloomy, and left deficits to be made good out of funds already on hand or to increase the debts already standing against the society.

We believe it is the intention of almost every society to live up to the purpose for which the fairs were instituted, but we sincerely wish there might be an improvement in the character of what may be called the camp followers of the fairs.

Respectfully submitted,

W. A. KILBOURN.
O. E. BRADWAY.
A. ELLSWORTH.
J. HARDING ALLEN.

# REPORT OF COMMITTEE ON EXPERIMENTS AND STATION WORK.

[Read and accepted at the Annual Meeting, Jan. 7, 1908.]

The improvements so far made at the college must be a great help to the experiment department, and evidently should be continued. A new, modern greenhouse is much needed. When we consider the commercial value of the products of the market-garden branch of agriculture in this State, we are convinced that trained men are needed for the practical work, and that the latest and best tools should be furnished for their use. A short winter term at the station would be beneficial.

In the entomological department, the increasing number of students seeking admission, and the lack of room to accommodate all applicants, show clearly the need of a larger building, as well as safer protection for the fine collection of specimens. This department has investigated the so-called oriental moth, which has appeared in Dorchester; and, while it has not yet increased in alarming proportions, it should be speedily stamped out where located.

We still believe the orchard to be one of the best paying assets of the farm, provided the trees are properly cultivated and cared for. The prevailing insect pests are a serious drawback, and our experimenters are laboring to provide preventives. There is also a discouraging amount of depredation from hoodlum boys, which has greatly increased of late, and after the labors of a whole season these ruthless invaders frequently steal or injure most of the orchard's results. Moral law having no effect, civil law should step in to check the tide of thieving, if possible; and the parents, being often the receivers of stolen fruit, should be held in a measure responsible. This condition is confined chiefly to the neighborhood of cities and towns, and proves a serious obstacle to fruit culture.

With a view to extending the cultivation of fruit in the sections of the State well adapted to the purpose, it might be well to give a short summer course in fruit culture at the station.

We would again ask for a remedy preventive of the hollyhock rust.

The Massachusetts Horticultural Society proposes this year to put some meaning into the State law for prizes for plantations of timber trees, and will offer a prize of $100 for a plantation of not less than five acres, planted four years, commencing in 1908, with a view of keeping in touch with the State forestry department. This has been a negative law long enough, and something is needed to vitalize it and make it of value to the Commonwealth.

Respectfully submitted,

WILLIAM H. SPOONER,
*Chairman.*

# Report to the Legislature of the State Board of Agriculture acting as Overseers of the Massachusetts Agricultural College.

[Revised Laws, chapter 89, section 10; adopted by the Board, Jan. 7, 1908.]

Your committee were at the college in June to examine the senior class in agriculture in competition for the Grinnell prizes. The entire class appeared well informed on the topics assigned them. The first prize, of $30, was awarded to James Hervey Walker of Greenwich Village; the second, of $20, to John Thomas Caruthers of Columbia, Tenn.

We also visited the institution in October, and again in November.

While some of the farm crops have suffered because of the extremely cold and wet weather during the first part of the season, others have produced exceptionally heavy yields, and fair crops have been harvested from most of the acreage.

At our autumn visits the new barn and silos were found well filled with hay and silage, and the stables sheltered a very creditable dairy herd.

Clark Hall, for the use of the botanical department, has been completed during the year, and the lecture rooms are now used by large classes.

A conference of those interested in rural progress was held during the first week in October, it being the fortieth anniversary of the opening of the college. A goodly number of strong speakers were enlisted in this movement, and representatives from many of our educational institutions, including the superintendents of schools from a number of country towns, were in attendance. We wish that a conference so valuable might have received the larger attendance it merited.

A summer school of four weeks was held during July and August, and was an unqualified success. This has caused the management to arrange for a more extensive and comprehensive course for the coming summer.

Short winter courses in dairying and bee-keeping have also been well patronized.

The faculty has been strengthened by the addition of several new men, and the institution has now enrolled more students than ever before in its history.

While agricultural and horticultural work undertaken for educational purposes must of necessity be expensive, still, it is the intention of the trustees and those directing the work to make the departments as practical as possible.

The increased interest in floriculture demands the erection of modern greenhouses to better illustrate modern methods. A liberal appropriation for this we deem necessary, as well as a suitable amount to thoroughly renovate North College.

Repairs are also very much needed upon the experiment station building, to make the rooms vacated by the botanical department suitable for use by the director.

In the near future the entomological department must be provided with increased accommodations, as last year 34 students sought admission to this course, when there was room for but 20.

The increased interest in all branches of agriculture appears to stimulate more of our young people to seek this institution for an education.

With the increased cost of all necessities, liberal appropriations will be needed to keep this college, as it has ever been, in the front. We believe that our Commonwealth will be glad to furnish with a liberal hand that which means so much for the education of our bright young men.

Respectfully submitted,

JOHN BURSLEY.
W. C. JEWETT.
ISAAC DAMON.
FRANK GERRETT.

# REPORT OF COMMITTEE ON GYPSY MOTH, INSECTS AND BIRDS.

*To the Massachusetts State Board of Agriculture.*

As in past years, your committee has kept as closely as possible in touch with the operations in connection with suppressing the gypsy and brown-tail moths, and has made visits of inspection to the sections where the most vigorous campaign is being waged. The scouting operations which have been carried on by Superintendent Kirkland since June, 1905, show that the gypsy moth is even more widely spread in the State than was expected at the beginning of the resumption of the work. The infested area embraces a large part of Barnstable County, all of Plymouth County and practically all of Norfolk and Middlesex counties. The most westerly infestations are those at Worcester and Lunenburg. The badly infested district still remains east of the line drawn from Quincy to Newton, northerly to Waltham and thence diagonally northeast to Newburyport.

In the central very badly infested district much progress has been made in suppressing the moth. In Medford and Malden, which for many years have been considered the most generally infested localities, such thorough work has been done that during the past season very little damage occurred from the gypsy moth. The most severely infested towns at present are Lexington, Woburn, Saugus, Lynn, Lynnfield and Salem.

During the past season it has been the policy of the State authorities to thoroughly protect the roadside trees, thereby stopping, so far as possible, the spread of the caterpillars by means of vehicles. Another line of effort has been to keep the residential sections as clear as possible of the gypsy moth, thereby relieving the property owners from annoyance and damage.

Any one familiar with the conditions existing in the district infested with the gypsy moth two years ago, as compared with those of the past summer, cannot but feel that great progress has been made in suppressing the pest in the residential districts. At the same time, the condition of the woodlands is sufficient cause for great anxiety. The woodlands in the area included within a radius of fifteen miles of Boston are thoroughly and generally infested, and a very large sum of money must be expended there if they are to be protected by the ordinary methods of treatment.

It is hoped, for the sake of these woodland sections, that the work of the imported parasites may soon be apparent. Large numbers of these insects have been reared at the Saugus laboratory and liberated in the wooded sections, where several important species are believed to have already established themselves. Those most familiar with this problem — Dr. L. O. Howard of Washington, who has direct oversight of it, and Superintendent Kirkland — are most hopeful of its ultimate success.

Your committee has been active in upholding the hands of the present management of the campaign against the gypsy moth in every way possible. It appeared and gave testimony in favor of increased appropriations at hearings before legislative committees last year, and we are glad to be able to say that these recommendations met the approval of the Legislature.

Your committee also favored the effort for increased national aid in suppressing the moths, both by correspondence and personally. Congress, after full discussion, made the appropriation for the year $150,000, as against $82,500 in 1906.

The brown-tail moth we shall undoubtedly always have with us, its strong flight and its being on the wing at the season when we are likely to have strong gales making it especially likely to infest and reinfest a district, even if it should successively be exterminated. It is a very troublesome insect in a way, causing great suffering to many people where it prevails; but its nests are so easily seen on the trees in the winter months that it is not an especially difficult operation to suppress the insect to such a degree that it will do comparatively little damage. As a leaf-eating insect it is not a pest of the first magnitude, and is only noteworthy because of its very disagreeable nettling or poisoning of the skin. The various cities and towns carry on very effective work against this insect under the law of 1905, and it seems likely to form a yearly tax upon real estate owners for many years to come. There are indications that it is already becoming susceptible to parasites and fungous diseases, and it is possible that these enemies may do much to reduce it in a comparatively short time. It is certainly much less tenacious than the gypsy moth in these respects, and for that reason is less of a menace as a permanent insect pest.

Of the other insects, the only one worthy of especial mention is the San José scale, another imported insect enemy, which is really a serious menace to our orchards and nurseries. Its extremely small size, its marvellously rapid increase, its covering scale, which makes destruction by contact so difficult, and its variety of food plants, make it a most dangerous foe. Living upon both bark and fruit, it greatly reduces the value of the latter where prevalent, as well as eventually destroying the tree if allowed to go unchecked. The only method of destroying it is by spraying with solutions coming in contact with the insect itself as it feeds by sucking the sap from the trees, and solutions strong enough to pierce its scale covering can only be applied during the winter months. The Board of Agriculture has issued an excellent leaflet upon this insect, which is available for free distribution wherever desired. This describes the insect and gives the best methods for destroying it, in considerable detail.

The law in relation to this insect was materially amended by the last Legislature, giving the State Nursery Inspector, elected by this Board, greatly increased authority, and making it possible for the scale to be cleaned out of private lands where the owner refuses to attend to it because of indifference. That much good can be accomplished by a rigid enforcement of this power is the belief of your committee, and we stand ready to give any aid within our power in this work.

Your committee also feels impelled to say a word in praise of the report on "Useful birds and their protection," by Edward Howe Forbush, Ornithologist of the Board. Mr. Forbush has put before the public the results of twenty-five years of study and experience, in an attractive and instructive form, without a cent of remuneration, but as the labor of a public-spirited citizen, giving freely of knowledge of value to the public. The report is generally admitted to be the most attractive and valuable book put out by the Commonwealth in years. Your committee joins heartily with the secretary of the Board in the recommendation that the Board ask for the establishment of the office of State Ornithologist, so that this work may be carried on and amplified in future.

AUGUSTUS PRATT.
JOHN M. DANFORTH.
WALTER D. ROSS.
W. C. JEWETT.
J. LEWIS ELLSWORTH.

# SIXTH ANNUAL REPORT

OF THE

# STATE NURSERY INSPECTOR

OF THE

# MASSACHUSETTS BOARD OF AGRICULTURE.

PRESENTED TO THE BOARD AND ACCEPTED,
JANUARY 7, 1908.

# SIXTH ANNUAL REPORT OF THE STATE NURSERY INSPECTOR.

*To the Secretary of the Board of Agriculture.*

I have the honor to submit herewith the sixth annual report of the State Nursery Inspector.

The inspection work during the season of 1907 has taken more time than heretofore, beginning earlier because of numerous calls for certificates. Apparently the nurseries now begin to ship stock nearly six weeks earlier in the fall than was formerly the case, and with some there is no break in the shipping season between the first of March and the middle of November. In order to meet the necessities of such places, certain inspections are made the first of July; but the regular examination of the remaining places has heretofore begun about a month later. This year, however, several requests for inspection were made early in July, on the ground that shipments were being called for, but could not be sent out until certificates had been obtained. Accordingly, the regular inspection was begun July 15, and was continued steadily, except when bad weather prevented, for about two months.

The rapid increase in the number and size of the nurseries of the State during the past five years has rendered inspection work increasingly difficult, and in order to complete it at all it has been necessary to work too rapidly for the best results. Last year, even though some of the nurseries for this reason were examined too hastily, several had to be omitted entirely because of an insufficient appropriation. This condition of the work was therefore presented to the Legislature, with a request for an increased appropriation, which was granted.

The result has been that a thorough inspection of every nursery was possible last summer, and it was evident that the necessary haste of previous inspections had prevented the discovery of diseased stock here and there. This stock has now been found and weeded out, and the nurserymen themselves agree with the inspector that the nurseries of Massachusetts are now in better condition as regards pests and diseases than ever before. The inspectors have been almost merciless in their work, perhaps; but it has seemed best to take no risks, and almost every tree and plant liable to bear dangerous diseases or pests has been individually examined.

One hundred and thirty-nine places were visited, owned by one hundred and thirty-three different persons or firms. One hundred and seventeen certificates were issued; at four places no stock was found, though there will probably be some another year; five places have stopped selling, and have gone out of business; in one case the settling of an estate prevents sales; in another, all stock is fumigated; and five places were refused certificates, infested stock being neither removed nor treated in accordance with the law.

None of the former deputy inspectors being available this year, three men who had received training in the work with this in view were appointed; viz., C. W. Hooker of Amherst, A. H. Armstrong of Hyde Park and H. M. Jennison of Millbury. During the first month of the inspection the deputies and the inspector worked together, in order to be certain that the proper methods were being pursued and that sufficient care was exercised in the inspection; after which different circuits among the smaller nurseries were assigned, and each inspector worked alone.

The changes in the law enacted by the Legislature of 1907 have given the desired results, and those pertaining to the protection of individuals seem to be satisfactory. No complaints have been entered under these provisions thus far, and this is as was anticipated, for, as a general rule, where such a law is in existence little use is made of it, though until such a law is enacted many complaints of lack of protection are made. It is probable that in some cases this law will be appealed to; but it is equally probable that its very existence will satisfy many who have complained most of the danger which threatens their property and of their lack of opportunity for redress, thus affording another example of the value of providing a statute to prevent actual legal measures.

The San José scale has now been found abundantly in the Housatonic valley, thus leaving only the higher parts of the Berkshire hills as places where this pest is not present in Massachusetts, and it is probable that it really is present there also, and will in time be discovered. The gypsy moth is becoming more dangerous to nurseries, as it is approaching many of them very closely, and the time must soon come when it will be present in some of the larger ones. Otherwise, insect conditions in the State, as affecting nurseries, appear to remain unchanged from the last report.

### Financial Statement.

| | | |
|---|---|---|
| Appropriation, | | $2,000 00 |
| Compensation of inspectors, | $962 50 | |
| Travelling and necessary expenses of inspectors, | 647 71 | |
| Supplies (postage, etc.), | 8 14 | |
| Unexpended balance, | 381 65 | |
| | | $2,000 00 |

The uniform kindness and assistance shown to the inspector and deputies in their work, which have so constantly been manifested by the secretary of the Board and by all concerned, have been much appreciated, and have often lightened burdens of responsibility and care which would otherwise have been heavy; and it is a pleasure to acknowledge this kindness and assistance here.

Respectfully submitted,

H. T. FERNALD,
*State Nursery Inspector.*

Amherst, Dec. 20, 1907.

## APPENDIX.

*List of Massachusetts Nurserymen entitled to sell Stock to June 30, 1908.*

| | |
|---|---|
| Adams, J. W., & Co., | Springfield. |
| American Forestry Co., | South Framingham. |
| Atkins, P. A., | Pleasant Lake. |
| Barrett, M. W., | Hyde Park. |
| Barrows, H. H., & Son, | Whitman. |
| Beach, Joseph, | South Hadley Falls. |
| Beals, E. B., | Springfield. |
| Bemis, A. L., | Worcester. |
| Boston Park Department, | Jamaica Plain. |
| Brandley, James, | Walpole. |
| Breed, E. W., | Clinton. |
| Briggs, L. H., | Smith's Ferry. |
| Brooks, H. N., | South Yarmouth. |
| Carr, C. E., | Dighton. |
| Casey, C., | Melrose. |
| Chase, Joseph S., | Malden. |
| Clapp, E. B., | Dorchester. |
| Conley, N. F., | Lexington. |
| Continental Nurseries, | Franklin. |
| Cutler, Miss Mary E., | Holliston. |
| Dighton Nursery Co., | Dighton. |
| Draper, James E., | Worcester. |
| Drewett, F., | Rockland. |
| Dwyer, E. F., & Son, | Lynn. |
| Eastern Nurseries, | Jamaica Plain. |
| Elliott, W. H., | Brighton. |
| Evans, E., | North Abington. |
| Evans, H. D., | Ayer. |
| Farquhar, R. and J., & Co., | Boston. |
| Field, H. W., | Northampton. |
| Fish, C. R., & Co., | Worcester. |
| Fogg, F. E., | Shawmut. |
| Ford, J. P., | East Weymouth. |
| Frost, G. Howard, | West Newton. |
| Gates, W. A., | Needham. |

| | |
|---|---|
| Geer, J. T., | Three Rivers. |
| Gilbert, A. L., | Springfield. |
| Gillett, Edw., | Southwick. |
| Gordon, A. B., | Randolph. |
| Gormley, E. W., | Jamaica Plain. |
| Guinivan, D. H., | Beverly. |
| Hastings, G. H., | Fitchburg. |
| Heurlein, Julius, | South Braintree. |
| Hitchcock, E. M., | Agawam. |
| Horne, H. J., & Co., | Haverhill. |
| Howard, J. W., | Somerville. |
| Huebner, H., | Groton. |
| Jahn, H. A., | New Bedford. |
| Jennison, W. C., | Natick. |
| Keizer, H. B., | Reading. |
| Kelsey, H. P., | Salem. |
| Keen, Cyrus R., | Cohasset. |
| King, R. B., | Nantucket. |
| Lawrence, H. V., | Falmouth. |
| Lips, Herman, | Bedford. |
| Lister, James, | Stoneham. |
| Littlefield, H. B., | Worcester. |
| Littlefield & Wyman, | North Abington. |
| MacGregor, J., | Braintree. |
| Macomber, F. S., | Myricks. |
| Mann, H. W., | Stoughton. |
| Manning, J. Woodward, | Reading. |
| Massachusetts Agricultural College, | Amherst. |
| Matthews, N., Jr., | Hamilton. |
| McCormack, J. J., | Malden. |
| McLaren, Anthony, | Westwood. |
| McManmon, J. J., | Lowell. |
| McMulkin, E., | Norfolk Downs. |
| Mead, H. O., | Lunenburg. |
| Miller, J. W., & Sons, | Lynn. |
| Moseley, F. S. (O. C. Bailey, superintendent), | Newburyport. |
| New England Nurseries, Inc., | Bedford. |
| Newton Cemetery Corporation, | Newton. |
| Oak Hill Nurseries, | Roslindale. |
| O'Connell, D., | Worcester. |
| Palmer, F. E., | Brookline. |
| Patterson, Wm., | Wollaston. |
| Payne, W. H., | Newtonville. |
| Peckham, S. S., | Fairhaven. |
| Peirce, C., | Dighton. |
| Phelps, F. H., | Lee. |

| | |
|---|---|
| Pierce, Jesse, | Beverly Farms. |
| Pratt, C. S., | Reading. |
| Pratt, H. M., | Concord. |
| Quinn, J., | Brookline. |
| Rea, F. J., | Norwood. |
| Rice, C. G. (F. A. Smith, superintendent), | Ipswich. |
| Richards, E. A., | Greenfield. |
| Richards, J. E., | Needham. |
| Richards, J. L., | Lunenburg. |
| Riley, Chas. N., | New Bedford. |
| Robinson, D. A., | Everett. |
| Robinson, L. D., Jr., | Springfield. |
| Sawyer, F. P., | Clinton. |
| Shirley & Fowle, | Danvers. |
| Shaw, F. E., | Rockland. |
| Southworth Bros., | Beverly. |
| Spinney, F. W., | Haverhill. |
| State Forester, | Boston. |
| Story, A. T., & Co., | Berkley. |
| Sullivan & McGrath, | Dorchester. |
| Sylvester, G. F., | Hanover. |
| Thurlow, T. C., | West Newbury. |
| Tuttle, A. M., | Melrose Highlands. |
| Twomey, M. T., | Roslindale. |
| Voornerveldt, H. H., | Nantucket. |
| Walsh, M. H., | Wood's Hole. |
| Walters, C., | Roslindale. |
| Watson, T. R., | Plymouth. |
| Wellesley Nursery Co., | Wellesley. |
| Whittet & Co., | Lowell. |
| Whittier, W. B., & Co., | South Framingham. |
| Willoughby, G. H., | Edgartown. |
| Wood, Edw., | Lexington. |
| Woodhouse, R. H., | New Bedford. |
| Wright, G. B., | Chelmsford. |
| Wyman, W. H., | North Abington. |
| Yamanaka & Co., | Boston. |

# TWELFTH SEMIANNUAL REPORT

OF THE

# CHIEF OF THE CATTLE BUREAU

TO THE

# MASSACHUSETTS

# STATE BOARD OF AGRICULTURE.

JANUARY 7, 1908.

# REPORT.

*To the State Board of Agriculture.*

The twelfth semiannual report of the Chief of the Cattle Bureau, as required by section 3 of chapter 116 of the Acts of 1902, is herewith respectfully submitted to your honorable Board.

This report gives in detail an account of the work of the Cattle Bureau for the fiscal year from Dec. 1, 1906, to Dec. 1, 1907.

Last September His Excellency the Governor authorized the Chief of the Cattle Bureau to represent this Commonwealth at the meeting of the Interstate Association of Live Stock Sanitary Boards, at Richmond, Va., which took place on the 16th and 17th of that month. While the west and south were well represented, as was also the United States Bureau of Animal Industry by its Chief and others, yet Massachusetts was the only northeastern State to send a delegate. At this meeting papers were read and discussed relating to "Meat inspection," "Milk inspection," "Tick eradication," and the "Control and suppression of rabies," the latter paper being by the delegate from Massachusetts.

At the time of making the tenth semiannual report, mention was made of the importance of a suitable system of meat inspection for the State, in slaughterhouses where there is no federal inspection by agents of the United States Bureau of Animal Industry. The same conditions obtain as at the time of making the last annual report. While the laws upon the statute books are adequate, their administration and enforcement are in the hands of the local authorities in the various cities and towns, with the result that the efficiency of the law is hampered by local politics, or its usefulness is impaired because it is not enforced.

The law provides that any one who intends to conduct a slaughtering establishment shall annually in the month of May apply for a license. In cities the mayor and aldermen, and in towns the selectmen, or such board as they may designate, or in a town of over five thousand inhabitants the board of health, if any, may grant slaughterhouse licenses. The licensing authority is required to report to the Chief of the Cattle Bureau the applications received for licenses and the action taken thereon. Under this provision of the law 39 cities and towns have reported licensing 81 slaughterhouses in 1907, against 50 cities and towns reporting 117 licensed slaughterhouses in 1906.

In 1906 the State Board of Health made an investigation of the slaughterhouses of the Commonwealth, and from its investigation and the figures in the Cattle Bureau office it appears that at that time there were slaughtering establishments in at least 210 of the 354 cities and towns of the State, comprising a much larger number of slaughterhouses, and there is no reason for believing that this number has diminished in 1907.

There must be a number of unlicensed slaughterhouses, and no doubt many cattle are killed that are unfit for beef, and calves that are too immature to be fit for veal. The law provides that a calf shall not be killed to be disposed of for food until it is four weeks old; but as a matter of fact the great majority of calves slaughtered have not reached this age, neither does it seem necessary that they should. If the law were changed, making it unlawful to dispose of a calf for food before it is three weeks old, it would be sufficient, and then it should be enforced, instead of being a dead letter as at present. Furthermore, the regulations of the United States Bureau of Animal Industry for meat inspection require a calf to be at least three weeks old, and in this respect they conflict with the Massachusetts law.

During the year ending Nov. 30, 1907, 48 meat-stamping outfits were furnished to 38 cities and towns through the Cattle Bureau office, as required by the provisions of chapter 220 of the Acts of 1903. The Legislature of 1902 repealed sections 103 and 104 of chapter 75 of the Revised Laws, which provided that animals killed for food should be stamped with a brand furnished to local boards of health through the office of the Cattle Commission, on the ground that it made an unwarranted expense for the smaller towns, that were thus required to do meat inspecting for neighboring cities which ought to stand the expense; but they were re-enacted by the Legislature of 1903 because it was thought that the law was a good one, and ought to remain in force.

These conflicting views, and the fact that in a majority of the cities and towns no attention is paid to the provisions of the law requiring that applications for slaughterhouse licenses and the action taken thereon be reported to the Chief of the Cattle Bureau, together with the lax manner in which the laws relating to meat inspection are enforced by the local authorities, are all arguments in favor of organizing a State system of slaughterhouse licensing and meat inspection, under the supervision of a competent central authority removed from the influence of local politics, and at the expense of the State, in order to relieve the small country towns from the burden of providing a system of meat inspection for the larger neighboring towns and cities.

The present law, providing that local boards of health shall order, through the Cattle Bureau office, a suitable stamp for branding meat, is incomplete in that it does not make it illegal for any one to provide himself with a similar brand, or to have one in his possession or use the same, and does not provide any penalty for an unauthorized person having or misusing such a stamp.

Most of the meat consumed in Massachusetts is brought here from the west in refrigerator cars, or killed in abattoirs here where the federal inspection is in force; hence the bulk of the meat consumed in this State has passed the inspection of agents of the United States Bureau of Animal Industry. That killed in the small local slaughterhouses, subject to lax or incompetent inspection or no inspection at all, constitutes but a very small percentage of the total amount consumed, probably not more than 3 or 4 per cent, but this should be under as careful supervision as the rest.

The veterinarian of the Boston Board of Health reports that during the year ending Nov. 30, 1907, there were 495 cases of tuberculosis found in cattle slaughtered at the Brighton Abattoir, of which 259 were condemned as unfit for food; and that out of 595 hogs in which tuberculosis was found, only 12 were condemned as unfit for food, the remaining number, 585, having only slight lesions of tuberculosis, and passing inspection as fit for food.

In addition to the cases reported by the Boston Board of Health, there were 73 cows, 1 calf and 12 swine reported outside of Boston as having tuberculosis, condemned as unfit for food by butchers and renderers during the past year; but if the requirements of the law providing that these reports shall be made to the Chief of the Cattle Bureau are no more carefully observed than the portions relating to slaughter-house licensing, there must have been a good many more cases that have not been reported.

The United States Bureau of Animal Industry inspects all animals and their products, killed for interstate commerce and export; but it exercises no supervision over animals shipped alive from one State to another in the east for dairy or breeding purposes or for slaughter. While large sums of money are spent in the west to prevent the spread of Texas fever, cattle mange and sheep scab from one State to another, nothing is done in the east to prevent the shipment of tuberculous cattle, cows known as "canners," bob calves and glandered horses from one State to another; and unless the State law or its live stock sanitary regulations give it some measure of protection, it can go without. The same observations also apply to the shipment of milk and dairy products from one Commonwealth to a neighboring one. If the United States Department of Agriculture supplied this inspection, and tested cattle destined for dairy and breeding purposes with tuberculin before shipment from one State to another, the money saved to a State in this way could be well expended toward eradicating contagious animal diseases within its limits.

In the report made to the Board last January reference was made to certain defects in the law, which it seemed desirable to ask the Legislature to remedy. Chapter 243 of the Acts of 1907 does this in part, which provides that certain reports required, by section 70 of chapter 56 and sections 100 and 111 of chapter 75 of the Revised Laws, to be made by boards of health, corporations and persons to the Board of Cattle Commissioners, shall hereafter be made to the Chief of the Cattle Bureau of the State Board of Agriculture; and that the penalties for failure to give such notice to the Chief of the Cattle Bureau shall be the same as are specified in such sections for failure to give such notice to the Board of Cattle Commissioners. Sections 11 and 27 of chapter 90 of the Revised Laws, which require notices of contagious diseases to be given to the Board of Cattle Commissioners, need amending so as to provide that these notices be sent to the Chief of the Cattle Bureau, in order to make the law operative, but through a misunderstanding the last Legislature failed to remedy this defect; it is to be hoped that the present one will perfect the law so as to render it operative.

## Rabies.

The outbreak of rabies which commenced three years ago has continued during the past year to a greater extent among dogs than at any time since it started. Although the number of cases in dogs has been larger, the amount of damage they have done to other animals and persons has been proportionately and actually less.

Pasteur observed that the virus of rabies in passing from dog to dog became less virulent; and in this outbreak it would seem that the number of cases of dumb rabies among the dogs is proportionately greater, and consequently the amount of damage done by them is proportionately less. But 3 people died from the bites of rabid dogs during the year 1907, as compared with 7 the previous eleven months; and 21 cattle, as compared with 38 the eleven months before; while the number of horses remains the same, 6 each year; yet in the twelve months ending Nov. 30, 1907, there were 741 cases of rabies among dogs, as compared with 327 the eleven months before. Rabies, however, was much more prevalent during the first half of the year than the latter half, as prior to June 1, 1,200 cases of those included in the table were entered on the Cattle Bureau books, and the other 788 have been received since.

At the time of making the tenth semiannual report, in January, 1907, it was stated that there were in quarantine at that time 98 dogs, 4 cows, 1 horse and 1 cat which had been exposed to the bites of rabid dogs. Eighty-two dogs, 4 cows, 1 horse and 1 cat were released from quarantine, 4 dogs were killed as rabid, and 12 dogs were killed by owners, not rabid.

Between Dec. 1, 1906, and Nov. 30, 1907, 1,985 animals and 3 persons have been entered upon the Cattle Bureau records as having rabies, or as having been exposed to the bites of rabid dogs.

The following table shows the species of animal and disposition of the cases: —

| | Dogs. | Cattle. | Horses. | Pigs. | Cats. | Persons. |
|---|---|---|---|---|---|---|
| Killed or died with rabies, . . | 662 | 21 | 6 | 4 | 4 | 3 |
| Killed by owners or died in quarantine, not rabid. | 522 | 2 | – | 10 | 11 | – |
| Reported as rabid, but found free from disease. | 46 | 5 | – | – | 5 | – |
| Released from quarantine, . . | 458 | 6 | 5 | 2 | 3 | – |
| Animals still in quarantine, . . | 209 | 1 | 2 | – | 1 | – |
| Totals, . . . . . . | 1,897 | 35 | 13 | 16 | 24 | 3 |
| Grand total, . . . . . | 1,988 | – | – | – | – | – |

In addition to the above, the veterinarian of the Boston Board of Health reports 79 cases of rabies in dogs and 2 in cattle that are not included in the table, making a total of 741 dogs and 23 cattle to have had rabies during the year.

Dr. Langdon Frothingham examined the brains of 281 animals and 1 man. The results of these examinations have shown that 218 dogs, 2 horses, 1 pig, 2 cows, 1 cat and 1 man were suffering with rabies at the time of death; and that 46 dogs, 5 cows and 5 cats, suspected of having rabies, were free from disease.

In addition to the cases of rabies among persons and animals, it must not be forgotten that many people were bitten by rabid dogs during the year who had to go to the trouble and expense of taking the Pasteur anti-rabic treatment, some of whom would undoubtedly have developed the disease and died if it were not for this means of prevention.

Reports of cases of rabies have been received from every county in the State except Barnstable, although Nantucket County can also be considered free, as there was only 1 case there, and the dog was taken there after being bitten at Vineyard Haven, and was kept confined and never did any damage. The trouble on Martha's Vineyard was secondary to an outbreak that occurred there in the summer of 1906, and was originated by a dog owned by a summer resident at Oak Bluffs who took an Irish terrier there that summer from East Milton.

Cases of rabies have been reported from 158 cities and towns, in every county in the State except Barnstable, as follows: —

Berkshire County: Adams, Cheshire, Dalton, Hancock, Lanesborough, Lee, New Marlborough, North Adams, Otis, Pittsfield, Williamstown, Washington.

Bristol County: Attleborough, Berkley, Dartmouth, Easton, Fall River, New Bedford, North Attleborough, Norton, Rehoboth, Seekonk, Somerset, Swansea, Taunton.

Dukes County: Oak Bluffs, Tisbury.

Essex County: Amesbury, Andover, Beverly, Haverhill, Lawrence, Lynn, Marblehead, Methuen, Salem, Saugus, Swampscott.

Franklin County: Bernardston, Gill, Northfield.

Hampden County: Blandford, Chester, Holyoke, Ludlow, Monson, Palmer, Springfield, Westfield, West Springfield, Wilbraham.

Hampshire County: Belchertown, Easthampton, Hadley, Huntington, Northampton, South Hadley, Williamsburg, Worthington.

Middlesex County: Arlington, Ashby, Ashland, Bedford, Belmont, Billerica, Cambridge, Carlisle, Chelmsford, Concord, Dracut, Dunstable, Everett, Framingham, Holliston, Hopkinton, Hudson, Lexington, Lincoln, Lowell, Malden, Marlborough, Medford, Melrose, Natick, Newton, Sherborn, Shirley, Somerville, Stoneham, Sudbury, Tewksbury, Townsend, Tyngsborough, Wakefield, Waltham, Watertown, Wayland, Westford, Weston, Wilmington, Winchester.

Nantucket County: Nantucket. (One dog taken from Vineyard Haven; did no damage.)

Norfolk County: Bellingham, Braintree, Brookline, Canton, Dedham, Hyde Park, Medfield, Medway, Millis, Milton, Needham, Norwood, Plainville, Quincy, Sharon, Stoughton, Walpole, Wellesley, Westwood, Weymouth, Wrentham.

Plymouth County: Abington, Bridgewater, Brockton, Duxbury, Hull, Kingston, Plymouth, Whitman.

Suffolk County: Boston (cases reported by courtesy of veterinarian of Boston Board of Health), Revere, Winthrop.

Worcester County: Clinton, Douglas, Fitchburg, Hopedale, Lancaster, Leominster, Lunenburg, Mendon, Milford, Millbury, Northborough, Northbridge, North Brookfield, Oxford, Rutland, Southborough, Southbridge, Sutton, Upton, Webster, Westborough, Westminster.

Early in the year rabies was so prevalent in many localities that a number of cities and towns issued orders requiring that all dogs within their respective limits should be properly and securely muzzled or restrained from running at large for periods varying from three to six months. In order to have these orders do the greatest possible amount of good, it seemed desirable that there should be a certain amount of co-operation among neighboring cities and towns, so that the same regulations might apply to a considerable area of contiguous territory. To accomplish this, the following order was approved in Council Jan. 2, 1907: —

## CATTLE BUREAU ORDER NO. 14.

COMMONWEALTH OF MASSACHUSETTS,
CATTLE BUREAU OF THE STATE BOARD OF AGRICULTURE,
STATE HOUSE, BOSTON, Dec. 29, 1906.

*To All Persons whom it may concern.*

By virtue of the power and authority vested by law in the Cattle Bureau of the State Board of Agriculture, under the provisions of chapter 90 of the Revised Laws and chapter 116 of the Acts of 1902, you are hereby notified that rabies, which is a contagious disease, and is so recognized under the laws of this Commonwealth, prevails extensively among dogs in some sections of this State.

In order to prevent its spread, and to check the loss of human life and the destruction of other animals by the bites of rabid dogs, the Chief of the Cattle Bureau hereby issues the following order: —

1. In any city or town within the limits of this Commonwealth (except the city of Boston), where, in the opinion of the Chief of the Cattle Bureau, there is danger of an outbreak of rabies, if the local authority, after being notified of such danger and advised by the Chief of the Cattle Bureau to order all dogs in such city or town properly and securely muzzled or restrained from running at large, under the authority given in section 158 of chapter 102 of the Revised Laws, refuses or neglects to do so for seven days after such notice, all dogs in any such city or town shall be securely muzzled or restrained from running at large for a period of six months from the date of notice to the local authority.

2. Dogs running at large unmuzzled contrary to the provisions of this order shall be killed.

3. All dogs and cats known to have been bitten by a dog known to have rabies, after this order takes effect, shall be killed.

4. All persons are forbidden to tamper with or disfigure any notices posted by order of the Chief of the Cattle Bureau, subject to the penalty of the law.

5. Any person violating the provisions of this order is liable to prosecution, as provided for in section 29 of chapter 90 of the Revised Laws.

6. Inspectors of animals in all cities and towns of this Commonwealth (except Boston) shall publish this order forthwith by posting a printed copy thereof in at least three public places within their respective cities or towns.

This order shall take effect upon its approval.

AUSTIN PETERS,
*Chief of Cattle Bureau.*

Council Chamber, approved in Council, Jan. 2, 1907.

EDWARD F. HAMLIN,
*Executive Secretary.*

As Newton, Quincy, Brookline and several other cities and towns around Boston issued muzzling orders for periods of from three to six months, it seemed advisable to request the selectmen of Milton to take similar action; but as they refused to do so, it seemed best to have the provisions of Order No. 14 apply. Notice was therefore given in the Milton

"Record" that dog owners of Milton must comply with the order for six months from January 29, and the following notice was sent by mail to the owner of every licensed dog in the town: —

COMMONWEALTH OF MASSACHUSETTS,
CATTLE BUREAU OF THE STATE BOARD OF AGRICULTURE,
STATE HOUSE, BOSTON, Jan. 29, 1907.

NOTICE TO DOG OWNERS OF THE TOWN OF MILTON.

Under the authority given by chapter 90 of the Revised Laws, chapter 116, Acts of 1902, and Cattle Bureau Order No. 14, Dec. 29, 1906, it is hereby ordered that all dogs in the town of Milton shall be *properly* and *securely* muzzled or restrained from running at large for six months, from Jan. 22, 1907. The selectmen of Milton having refused to issue an order under the authority given them by section 158 of chapter 102 of the Revised Laws, within seven days after being notified of the danger and advised to do so by the Chief of the Cattle Bureau of the State Board of Agriculture, Cattle Bureau Order No. 14 takes effect.

A muzzle must be so constructed as to prevent a dog from biting. Any dog running at large wearing a device that does not act as an efficient muzzle will be looked upon in the same light as a dog that does not wear any.

AUSTIN PETERS,
*Chief of the Cattle Bureau.*

This is the only instance where such a step was necessary, as selectmen in other towns have issued the necessary order when advised to do so. No further steps were taken to enforce the order in Milton than sending the letter to dog owners, yet there was not a case of rabies in the town from January 29 to July 29, although there have been cases since of rabid dogs appearing there from other towns, and also cases in dogs owned in the town.

In order to still further diminish the danger from rabies, the following circular was sent the first of May to the mayor of every city except Boston, the selectmen of every town, the board of health in every city and town, the chief of police in every city and town, and inspectors of animals in every city and town except Boston: —

COMMONWEALTH OF MASSACHUSETTS,
CATTLE BUREAU OF THE STATE BOARD OF AGRICULTURE,
STATE HOUSE, BOSTON, May 1, 1907.

*To the Mayors and Aldermen of Cities, Selectmen of Towns, Boards of Health, Physicians, Veterinarians, Inspectors of Animals and Others whom it may concern.*

Owing to the alarming prevalence of rabies, you are hereby notified to strictly adhere to the following rules in dealing with suspected cases of this disease: —

### 1. DOGS SHOULD NOT BE KILLED.

If a person has been bitten by a dog, and desires to ascertain whether or not it is rabid, *do not kill the dog* (unless his extreme violence *absolutely necessitates* it), but confine him, so that he cannot possibly escape (in a box stall, or room, for example). Give him food and water, and notify the Cattle Bureau immediately. Keep confined for ten days. If during this period of time no symptoms of rabies appear in the animal, there is *no danger* of the one bitten having been infected; but should characteristic symptoms develop, the person bitten should begin the Pasteur preventive treatment at once. On the contrary, if the dog is killed before symptoms of rabies are evident, the microscopic examination may prove negative or doubtful, and inoculations must be made to prove the existence or nonexistence of rabies. It may take several weeks or months before the result of such inoculations is known; thus much valuable time is lost, and persons bitten must remain in anxious doubt.

### 2. BITES.

Bites of dogs or other animals suspected of being rabid should be treated as soon as possible with *strong, fuming nitric acid.* The best way to apply the acid is with a capillary glass pipette, which should be inserted to the bottom of all wounds. (If no pipette is at hand, use a wooden toothpick.) In case of severe wounds upon the head or face, it is well to etherize the patient, that the acid may be applied with the utmost thoroughness and care. Experiments have demonstrated that no other cauterization, not even actual cautery, is as efficacious as nitric acid. It causes no serious local injury, and should be applied even if a day has elapsed since the bite was inflicted.

### 3. DESTRUCTION OF SUPPOSED RABID ANIMALS.

*Do not shoot an animal in the head with a shot-gun* at close range. By so doing the brain will undoubtedly be ruined, and a careful microscopic examination cannot be made. Moreover, a brain thus injured quickly putrefies, especially in warm weather, so that inoculations are also impossible. If an animal *must* be shot, it should be done with a pistol, and the bullet should enter the *forward* part of the brain, otherwise important regions for examination will be destroyed. It is better still, when possible, to shoot the dog through the heart; but where it can be done, chloroforming is preferable to shooting.

### 4. SHIPPING.

If a post-mortem diagnosis of an animal supposed to have been rabid is desired, cut off the head, *keep it cold,* wrap it in cloth, pack in a box or pail with plenty of sawdust and *ice,* and send it to the Cattle Bureau, State House, Boston, Mass. *Ice* is *most essential* in warm weather, and especially in cases where the skull has been fractured and the brain exposed or severely injured, as putrefaction will quickly occur, preventing inoculations, should they be necessary. Sawdust, excelsior or waste should be used, to prevent the leakage of blood, etc.

*Avoid* shipping so that the head will reach Boston on a *Saturday afternoon* or the afternoon before a *holiday,* as it will not be delivered until Monday morning or the morning after the holiday, and much putrefaction will have occurred, as the result of remaining so long in a warm express office. If practicable, the head should be kept at a cold-storage plant until shipped.

AUSTIN PETERS,
*Chief of Cattle Bureau.*

Later, notices of changes in the dog law were sent to the chairmen of the county commissioners and mayors of cities and selectmen of towns, in the following letters: —

COMMONWEALTH OF MASSACHUSETTS,
CATTLE BUREAU OF THE STATE BOARD OF AGRICULTURE,
STATE HOUSE, BOSTON, June 13, 1907.

*To the Chairman of the County Commissioners of County.*

DEAR SIR: — I desire to call your attention to chapter 241 of the Acts of 1907, which reads as follows: —

Section one hundred and fifty-five of chapter one hundred and two of the Revised Laws, as amended by chapter one hundred and forty-two of the acts of the year nineteen hundred and four, is hereby further amended by inserting after the word "it", in the eighteenth line, the words: — Said officer shall have concurrent jurisdiction with the officer or officers appointed under authority of section one hundred and forty-three, — so as to read as follows: — *Section 155.* The county commissioners, except in the county of Suffolk, shall appoint a suitable person residing in the county who shall, at the request of said commissioners, or of the chairman of the selectmen of a town or officer of the police designated as provided in section one hundred and fifty-one, investigate any case of damages done by a dog of which such commissioners, chairman or officer shall have been informed as provided in said section, and if he believes that the evidence is sufficient to sustain an action against the owner or keeper of a dog as provided in section one hundred and sixty-two and believes that such owner or keeper is able to satisfy any judgment which may be recovered in such action, he shall, unless such owner or keeper before action brought pays him such amount in settlement of such damages as he deems reasonable, bring such action. It may be brought in his own name and in the county in which he resides, and he shall prosecute it. Said officer shall have concurrent jurisdiction with the officer or officers appointed under authority of section one hundred and forty-three. All awards received or recovered by him in such actions shall be paid over to the county treasurer and placed to the credit of the dog fund. The county treasurer shall pay out of the dog fund such reasonable compensation as the county commissioners shall allow to such person for his services and necessary expenses and the reasonable expense of prosecuting such actions. The person appointed may be removed at any time by the county commissioners, and in counties in which he is appointed, the county treasurer shall not be authorized to bring such actions. [*Approved March 25, 1907.*

You see by the above act that the county commissioners, except in the county of Suffolk, are to appoint a person residing in the county to assist in a stricter enforcement of the dog law.

It may seem to you that it is superfluous for me to call your attention to this act. I should consider it so myself if it were not for the prevalence of rabies in the Commonwealth during the past two years. As I believe that a better and stricter enforcement of the dog laws will assist materially in the eradication of this disease, it appears to me that I am not exceeding my duty as Chief of the Cattle Bureau in calling your attention to this act, as it seems only proper for me to take all steps that can be taken towards the suppression of such a dangerous contagious disease among dogs.

I remain, yours respectfully,

AUSTIN PETERS,
*Chief of Cattle Bureau.*

COMMONWEALTH OF MASSACHUSETTS,
CATTLE BUREAU OF THE STATE BOARD OF AGRICULTURE,
STATE HOUSE, BOSTON, July 1, 1907.

*To the Mayors of Cities and Selectmen of Towns.*

Your attention is called to chapter 240 of the Acts of 1907, which reads as follows: —

AN ACT RELATIVE TO THE TERM OF OFFICE OF OFFICERS APPOINTED TO ENFORCE THE LAWS CONCERNING UNLICENSED DOGS.

*Be it enacted, etc., as follows:*

SECTION 1. Section one hundred and forty-three of chapter one hundred and two of the Revised Laws is hereby amended by inserting after the word "constables", in the third and fourth lines, the words: — who shall hold office for one year or until his or their successor or successors are appointed and qualified, — so as to read as follows: — *Section 143.* The mayor of each city and the chairman of the selectmen of each town shall annually, within ten days after the first day of July, issue a warrant to one or more police officers or constables, who shall hold office for one year or until his or their successor or successors are appointed and qualified, directing them forthwith to kill or cause to be killed all dogs within such city or town which are not licensed and collared according to the provisions of this chapter, and to enter complaint against the owners or keepers thereof; and any person may, and every police officer and constable shall, kill or cause to be killed all such dogs whenever or wherever found. Such officers, other than those employed under regular pay, shall receive from the treasurers of their respective counties one dollar for each dog so destroyed; but in the county of Suffolk, they shall receive it from the treasurers of their respective cities or towns. Bills for such services shall be approved by the mayor of the city or chairman of the selectmen of the town in which said dogs are destroyed, and shall be paid from moneys received under the provisions of this chapter relating to dogs.

SECTION 2. Section one hundred and forty-four of said chapter one hundred and two is hereby amended by striking out the words "return the same on or before the first day of October following", in the second and third lines, and inserting in place thereof the words: — make returns on or before the first day of the October following and at the expiration of his term of office, — and by striking out the word "return", in the fifth line, and inserting in place thereof the word: — returns, — so as to read as follows: — *Section 144.* Each police officer or constable to whom the warrant named in the preceding section is issued shall make returns on or before the first day of the October following and at the expiration of his term of office, to the mayor or chairman of selectmen issuing the same, and shall state in said returns the number of dogs killed, the names of the owners or keepers thereof and whether all unlicensed dogs in his city or town have been killed, and the names of persons against whom complaints have been made under the provisions of this chapter and whether complaints have been entered against all the persons who have failed to comply with said provisions. [*Approved March 25, 1907.*

You will see by the above that the dog officers are now appointed to be on duty during the entire year, instead of from the first of July until the first of October, as formerly.

It might at first glance appear that it was outside of the province of the Chief of the Cattle Bureau to call your attention to the provisions of this chapter; but owing to the prevalence of rabies in Massachusetts during the past two years, I believe that a stricter enforcement of the law relating to the licensing of dogs, and having the owners supply them with suitable collars on which the name of the owner and the license number are engraved, will lead to the destruction of large numbers of ownerless, homeless and stray dogs, which are the animals that play the most important part in the dissemination of rabies. It therefore seems that in taking steps for the suppression of a contagious disease I am not going beyond the bounds of propriety in calling your attention to the provisions of the chapter quoted above.

Yours respectfully,

AUSTIN PETERS,
*Chief of Cattle Bureau.*

In Massachusetts the law requires owners of dogs to license them, and the law also provides that the secretary of the State Board of Health shall furnish a description of the symptoms of hydrophobia, to be printed on the back of each dog license. There is much useful information to be derived by reading the back of one of these licenses. First, attention is called to the fact that the law requires that every dog over three months old shall be licensed, and that each licensed dog shall wear a collar around his neck, with a plate upon which the owner's name and the license number shall be engraved. If this provision of the law were better enforced, and all unlicensed, homeless, ownerless dogs, and dogs whose owners did not provide collars prescribed by law, were humanely destroyed, it would be a great safeguard to the public. Half or two-thirds of the rabid dogs which have appeared in towns and have bitten other dogs, animals or persons, have had no collar, or at least no collar with a plate upon it to show who owned the animal or where it came from.

Next on the license is some information upon the treatment of dogs and the diseases of dogs, which does not seem essential to a dog license. Following this is a description of the symptoms of hydrophobia, which commences by stating that when rabies does not prevail it is a rare disease, and when it does it is not uncommon, and has a tendency to become epizoötic; the symptoms then described give a very good idea of the behavior and appearance of a dog with either dumb or furious rabies. Then follows some excellent advice upon the course to be pursued by persons bitten by dogs supposed to be rabid, and also upon the treatment of a dog which has bitten any one.

Persons are advised against the folly of calling a dog rabid because it bites some one, and immediately killing it before it is definitely known whether it has rabies or not. In such cases the dog should be confined and kept under observation for several days; if at the end of a week it is apparently healthy, no apprehension need be felt because of rabies. Under such circumstances, never use a rope for tying up a dog, as it may gnaw it in two and escape. The owner of a licensed dog is also cautioned not to turn a dog loose to shift for itself because it appears to be sick or acts strangely, — advice that has been disregarded with unfortunate results in many instances. Josh Billings said, "The meanest thing a man can do to another, except doing him an absolute injury, is to do him a favor and then keep reminding him of it all the time." But it is meaner still to kick a poor, sick dog out of doors when you don't know what ails him.

It is also recommended, in conclusion, that the head of a dog supposed to have had rabies should be sent packed in ice to the Cattle Bureau, or to any laboratory equipped for making an inoculation test, in order to determine whether or not the animal had this disease at the time of its death.

Dogs developing rabies often act as though there was an obstruction in the throat, due to the difficulty in swallowing, because of the paralysis of the pharynx. In these cases don't put a finger down the dog's throat in an attempt to remove the obstruction, as it is often followed by disastrous results. It is dangerous to put the finger or hand in a rabid dog's mouth, even if it should not bite, as the skin might be abraded by a scratch from a tooth, or the virus may be absorbed through a fresh cut or scratch on the hand not inflicted by the animal's tooth. Many a veterinary surgeon has found out the danger of such a procedure, to his cost. There is also to be noticed the partial paralysis of the lower jaw; the staggering gait; snapping at imaginary flies; the tendency to swallow foreign bodies, such as bits of wood, small stones, feathers, bits of leather and the like. There is often a disposition to run away from home when the disease is about to manifest itself; the animal may be gone a day or two and then return, or it may never come home. Rabid dogs frequently run many miles from home, from twenty to forty or fifty not being an unusual distance to travel.

Rabies in other animals, such as horses, cattle, pigs and cats, is manifested by similar symptoms; that is, there is the preliminary excitement, paralysis of the pharynx, salivation, and later staggering gait from loss of nervous power, followed by complete paralysis and death. In cattle there is a tendency to paralysis of the lower jaw, shown by its drooping, with salivation, inability to swallow, and excitement, the animal in the early stages having a tendency to be violent. Horses frequently tear at the seat of the bite with their teeth, and also may bite or kick at any one who approaches. Pigs run around their pens squealing, and also are inclined to bite. The disease usually lasts in these animals from four to six days. Cats with rabies frequently have a desire to bite and scratch, and their bites are very dangerous; the disease usually lasts from two to four days.

There seems to be but little danger of rabies being spread except by dogs, or the dog family, such as wolves and foxes (possibly skunks), and not much danger from the bites of any except carniverous animals, such as the canine family and cats. Out of twelve thousand persons bitten by rabid animals, Pasteur found that eleven thousand were bitten by dogs and over seven hundred by cats. The horse, ox and pig as factors in spreading rabies do not have to be considered.

There is ample legislation for the regulation of the dog problem, such as laws requiring owners to license them, to provide collars bearing plates upon which are inscribed the address of the owner and the license number, and the appointment of a dog officer or officers in each city and town to see that ownerless, stray and unlicensed dogs are killed off each year, after giving owners a reasonable length of time in which to secure licenses for their canines. The local authorities also have ample power in the event of an outbreak of rabies to require that all dogs shall be properly and securely muzzled or restrained from running at large.

The difficulty seems to be that in many communities the local authorities are lax in the enforcement of such orders, and while the laws are good, they are rendered inoperative because of their nonenforcement.

The same difficulty was met with in England, where it was found that much more rapid progress was made in the eradication of rabies when muzzling and restraining orders were issued by the Board of Agriculture than when they were issued by the local government boards. Muzzling orders particularly are often not properly enforced, and dog owners use so-called muzzles that are inefficient because they do not prevent a dog from biting. A restraining order well enforced is better in many respects than an order to muzzle or restrain. Then the muzzling order does not as a rule cover a sufficient length of time; and, again, one town may issue a muzzling and restraining order and the next town may not, and therefore the order does not cover a sufficiently large area of contiguous territory, especially when one takes into consideration the distance a rabid dog frequently runs. In these cases the State authority should assert itself, to secure co-operation between communities and a stricter enforcement of the law.

One difficulty in managing rabies is due to the varying period of its incubacy, as a dog may develop rabies in two or three weeks after being bitten, or it may go four or five months or even longer before showing symptoms.

When the danger and seriousness of such a disease as rabies are considered, it would appear to be of sufficient importance to warrant the Bureau of Animal Industry of the United States Department of Agriculture to take the matter up under the authority given by act of Congress to the Secretary of Agriculture.

If the various State veterinarians, live stock sanitary boards, cattle commissioners, or whatever the authorities having control of the contagious diseases of animals in the different States may be, could be required to report annually to the

Chief of the United States Bureau of Animal Industry upon the prevalence of contagious diseases among animals in each State, and then the United States authority could prohibit taking dogs from States in which rabies existed into any other State, it would be a great protection. I understand of course that in many States the State authority can prohibit bringing in dogs from any other State, but the sentiment of the community does not always support such regulations. Local sentimentality of this kind would probably have less influence with the United States Secretary of Agriculture.

Although rabies has been stamped out in Great Britain, the English Board of Agriculture recommends a continuance of the rigid enforcement of the law requiring dogs to be duly licensed and collared, for the protection of cattle and sheep against worrying. It also has authority, in localities where the necessity exists, to order all dogs, or certain classes of dogs, to be restrained between sunset and sunrise. There is also a provision in the English law exempting owners of dogs from paying licenses on "dogs kept and used solely for the purpose of tending cattle and sheep on a farm." In 1906, in Great Britain, under this provision of the law 1,664,824 dogs were licensed, and certificates of exemption were granted to 347,039.

The Year Book of the United States Department of Agriculture for 1906 gives the following figures for the live stock in the United States: cattle, 74,150,422; horses, 22,683,881; mules, 3,990,908; sheep, 53,471,301; swine, 56,612,114.

The report of the English Board of Agriculture shows the following number of farm animals in Great Britain in 1906: cattle, 7,010,856; horses, 1,568,681; sheep, 25,420,360; swine, 2,323,461.

That is, we have 1 sheep to 1.38 neat cattle, and 1 sheep to 1.05 swine; while in Great Britain there are more than 3 sheep to every head of neat cattle, and over 10 sheep to every pig. With the present prices of wool and meat products, it would seem desirable that a much larger number of sheep should be kept in this country than at present; but in many of the more thickly populated States one factor that acts as a deterrent is the ravages of dogs.

The inspector of animals for the town of Edgartown, in his annual report of inspection of premises and farm animals for 1907, states that 73 sheep in that town were killed by dogs during the year.

Every dog owner ought to feel the responsibility resting upon him for the good behavior of his canines; and a system of dog management that ruins the sheep industry in the older and more thickly populated portions of the country, and allows this privileged species of domestic animal to prowl around destroying human life and other domestic animals and fowls, should be brought to a speedy termination.

At the time of making the report a year ago, the proposition for an increase in the dog tax awakened a great deal of hostility among dog fanciers, and led to a great deal of opposition among certain ignorant and unthinking people to the efforts of the Chief of the Cattle Bureau for the suppression of rabies; but to offset this opposition there was the magnificent support given him by people who realize the dangers from the disease and the importance of preventing its ravages. The medical profession as a whole endorsed the work of the Chief of the Cattle Bureau; the Boston Society for Medical Improvement, the Boston Medical Library Meeting held under the auspices of the Suffolk Branch of the Massachusetts Medical Society, the Norfolk Branch of the Massachusetts Medical Society, and the Hampshire County Medical Society, all passed resolutions endorsing the work. The thanks of the unprejudiced members of the community are due to the medical profession for the encouragement and support given the State authority during a most trying experience.

## Glanders.

The number of cases of glanders and farcy in Massachusetts shows a decided increase over the previous year, the total number of horses and mules that have been killed or died with this disease during the year ending November 30 being 711, as compared with 570 for the year previous.

At first glance it would appear that there had been an alarming increase in the State, but in reality the increase of the number of cases within the jurisdiction of the Cattle

Bureau is small in comparison with the total increase, and there were fewer cases killed outside of Boston in 1907 than in 1905.

The city of Boston is no more part of Massachusetts, so far as the authority of the Cattle Bureau is concerned in connection with glanders and farcy in horses or rabies in dogs, than is Providence, Rhode Island or New York City. The figures in Boston are furnished only by the courtesy of the Boston Board of Health, as there is not even anything in the law requiring it to report these cases, and the only reason for including them in this report is that, as Boston is supposed to be a part of the Commonwealth of Massachusetts, these figures are added in order to make the statistics of the contagious diseases of animals complete.

The Boston Board of Health reports that there were 308 cases of glanders or farcy among horses and mules in that city during the year ending Nov. 30, 1907, which was 114 more than during the eleven and one-half months preceding Dec. 1, 1906. For the eleven and one-half months ending Nov. 30, 1906, the number of cases of glanders and farcy reported from Boston was about 34 per cent of the total number in the State, while for the year ending Nov. 30, 1907, it rose to over 43 per cent.

There was a combined increase of 39 cases over the previous year in Brookline, Cambridge, Chelsea, Milton, Newton, Watertown, Dedham, Quincy and Winthrop, all towns abutting on Boston, from which team and express horses go back and forth daily to their work, while the total increase in glanders and farcy outside of Boston over the previous year was but 27; therefore, deducting these 39 cases, there was actually a decrease of 12 cases from the previous year in the rest of the Commonwealth.

There was a decrease in 1907 of 5 cases in Somerville, 1 in Hyde Park and 12 in Everett. Of the 711 cases of glanders or farcy, 508, or 71 per cent, were within ten miles of the State House. Four hundred and fifty-four, or over 63 per cent, occurred in Boston and the abutting towns of Chelsea, Winthrop, Somerville, Cambridge, Watertown, Newton, Brookline, Dedham, Hyde Park, Milton and Quincy.

The following table shows the distribution of glanders throughout the State, and the increase or decrease from the previous year in towns where it occurred. It will be seen that the State is practically free of the disease west of Worcester, and there it decreases slightly from year to year. The cases in Deerfield and Brimfield were in second-hand horses brought up from Jersey City last spring by a trader in Deerfield, and the case in North Adams came from Troy, N. Y.

| CITY OR TOWN. | 1906. | | 1907. | | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | Killed or died. | Negative. | Killed or died. | Negative. | | |
| Acton, . . . | 1 | – | 1 | – | – | – |
| Acushnet, . . . | 1 | – | – | – | – | 1 |
| Adams, . . . | – | – | – | 1 | – | – |
| Amesbury, . . . | – | – | – | 1 | – | – |
| Andover, . . . | 2 | 8 | 1 | 4 | – | 1 |
| Arlington, . . . | 5 | 6 | 1 | 1 | – | 4 |
| Ashby, . . . | – | – | 1 | – | 1 | – |
| Athol, . . . | – | 2 | – | 1 | – | – |
| Attleborough, . . | 5 | 3 | 5 | 2 | – | – |
| Auburn, . . . | 2 | 1 | 1 | – | – | 1 |
| Barre, . . . | 1 | 1 | – | – | – | 1 |
| Bedford, . . . | 2 | 1 | 3 | 14 | 1 | – |
| Belchertown, . . | – | 1 | – | 1 | – | – |
| Belmont, . . . | 1 | – | 2 | – | 1 | – |
| Berkley, . . . | – | 1 | 1 | – | 1 | – |
| Berlin, . . . | – | – | 2 | 4 | 2 | – |
| Beverly, . . . | – | – | 3 | – | 3 | – |
| Billerica, . . . | 2 | 1 | – | – | – | 2 |
| Blackstone, . . . | 1 | 1 | 5 | 1 | 4 | – |

| CITY OR TOWN. | 1906. | | 1907. | | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | Killed or died. | Negative. | Killed or died. | Negative. | | |
| Boston, . . . . | 194 | 9 | 308 | 18 | 114 | – |
| Boylston, . . . . | 2 | 3 | – | – | – | 2 |
| Braintree, . . . . | 4 | 1 | 1 | – | – | 3 |
| Bridgewater, . . . | 1 | – | – | 1 | – | 1 |
| Brimfield, . . . . | – | – | 2 | – | 2 | – |
| Brockton, . . . . | 1 | 4 | – | – | – | 1 |
| Brookline, . . . . | 2 | 3 | 8 | 54 | 6 | – |
| Cambridge, . . . . | 42 | 75 | 48 | 68 | 6 | – |
| Canton, . . . . | 5 | 1 | – | – | – | 5 |
| Charlton, . . . . | – | – | 1 | 1 | 1 | – |
| Chelmsford, . . . . | – | – | 2 | 1 | 2 | – |
| Chelsea, . . . . | 12 | 2 | 19 | 2 | 7 | – |
| Chester, . . . . | – | – | – | 1 | – | – |
| Clinton, . . . . | – | – | – | 1 | – | – |
| Concord, . . . . | 1 | – | 1 | – | – | – |
| Conway, . . . . | – | – | – | 1 | – | – |
| Dana, . . . . . | – | – | – | 1 | – | – |
| Dartmouth, . . . . | 3 | 1 | 1 | – | – | 2 |
| Dedham, . . . . | 1 | 1 | 3 | – | 2 | – |
| Deerfield, . . . . | – | – | 1 | 2 | 1 | – |
| Douglas, . . . . | 1 | 1 | – | – | – | 1 |
| Dracut, . . . . | 1 | – | 1 | 1 | – | – |
| Dudley, . . . . | – | – | 4 | – | 4 | – |
| East Bridgewater, . . | – | – | – | 1 | – | – |
| Easton, . . . . | – | – | 2 | – | 2 | – |

| CITY OR TOWN. | 1906. |  | 1907. |  | Increase. | Decrease. |
|---|---|---|---|---|---|---|
|  | Killed or died. | Negative. | Killed or died. | Negative. |  |  |
| Enfield, . . . | – | – | – | 1 | – | – |
| Essex, . . . | – | – | 1 | – | 1 | – |
| Everett, . . . | 16 | 2 | 4 | 2 | – | 12 |
| Fairhaven, . . . | 1 | 1 | – | – | – | 1 |
| Fall River, . . . | 4 | – | 6 | 12 | 2 | – |
| Falmouth, . . . | 1 | – | – | – | – | 1 |
| Fitchburg, . . . | – | – | 1 | – | 1 | – |
| Foxborough, . . | – | 1 | – | 1 | – | – |
| Framingham, . . | – | 1 | 1 | – | 1 | – |
| Franklin, . . . | 2 | – | 1 | – | – | 1 |
| Gardner, . . . | – | – | – | 1 | – | – |
| Georgetown, . . . | – | – | 1 | – | 1 | – |
| Gill, . . . . | – | – | – | 1 | – | – |
| Grafton, . . . | 2 | – | 2 | 2 | – | – |
| Greenfield, . . . | – | 1 | – | 2 | – | – |
| Groton, . . . | – | – | – | 1 | – | – |
| Hanover, . . . | 1 | 1 | – | 3 | – | 1 |
| Hardwick, . . . | 1 | – | – | – | – | 1 |
| Harwich, . . . | – | – | 1 | – | 1 | – |
| Haverhill, . . . | 1 | 2 | 6 | 3 | 5 | – |
| Hingham, . . . | – | – | 1 | – | 1 | – |
| Holden, . . . | – | – | 1 | – | 1 | – |
| Holyoke, . . . | 1 | 1 | – | 2 | – | 1 |
| Hopkinton, . . . | – | – | 1 | – | 1 | – |
| Hudson, . . . | – | – | 1 | – | 1 | – |

| CITY OR TOWN. | 1906. | | 1907. | | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | Killed or died. | Negative. | Killed or died. | Negative. | | |
| Hull, | – | – | – | 1 | – | – |
| Hyde Park, | 2 | – | 1 | – | – | 1 |
| Ipswich, | – | – | – | 1 | – | – |
| Lawrence, | 20 | 18 | 5 | 2 | – | 15 |
| Leicester, | 1 | 2 | – | – | – | 1 |
| Lenox, | 5 | – | – | – | – | 5 |
| Lexington, | 4 | 1 | 1 | – | – | 3 |
| Lowell, | 6 | 6 | 15 | 4 | 9 | – |
| Lynn, | 12 | 2 | 22 | 17 | 10 | – |
| Lynnfield, | 2 | – | – | 1 | – | 2 |
| Malden, | 3 | – | 5 | 3 | 2 | – |
| Marblehead, | 1 | – | – | – | – | 1 |
| Marlborough, | – | – | – | 1 | – | – |
| Marshfield, | 2 | – | – | 1 | – | 2 |
| Medfield, | – | 1 | 1 | – | 1 | – |
| Medford, | 5 | – | 3 | – | – | 2 |
| Melrose, | 1 | – | 1 | – | – | – |
| Merrimac, | 1 | – | – | – | – | 1 |
| Methuen, | – | 1 | 2 | 1 | 2 | – |
| Milford, | 1 | – | 2 | – | 1 | – |
| Millbury, | 1 | – | 1 | – | – | – |
| Milton, | 3 | – | 4 | 4 | 1 | – |
| Natick, | 3 | 1 | – | – | – | 3 |
| Needham, | – | 1 | 2 | – | 2 | – |
| New Bedford, | 7 | – | 5 | – | – | 2 |

| CITY OR TOWN. | 1906. | | 1907. | | Increase. | Decrease. |
|---|---|---|---|---|---|---|
| | Killed or died. | Negative. | Killed or died. | Negative. | | |
| Newburyport, . . | 1 | – | – | 1 | – | 1 |
| Newton, . . . | 6 | 3 | 12 | 1 | 6 | – |
| North Adams, . . | – | – | 1 | – | 1 | – |
| North Andover, . . | 1 | 1 | – | 1 | – | 1 |
| North Attleborough, . | 2 | – | 9 | 2 | 7 | – |
| Northampton, . . | – | 1 | – | 1 | – | – |
| Norfolk, . . . | 3 | – | 3 | – | – | – |
| Northfield, . . . | – | – | – | 1 | – | – |
| North Reading, . . | 1 | – | – | – | – | 1 |
| Norton, . . . | 1 | – | 2 | – | 1 | – |
| Norwood, . . . | – | 2 | – | 1 | – | – |
| Oxford, . . . | – | 2 | 1 | 1 | 1 | – |
| Paxton, . . . | 1 | – | – | – | – | 1 |
| Peabody, . . . | 6 | 1 | 3 | – | – | 3 |
| Pelham, . . . | – | – | – | 1 | – | – |
| Pepperell, . . . | 1 | – | – | – | – | 1 |
| Pittsfield, . . . | 1 | – | – | – | – | 1 |
| Plymouth, . . . | – | 1 | – | 1 | – | – |
| Princeton, . . . | 1 | 2 | 1 | 1 | – | – |
| Quincy, . . . | 1 | 3 | 7 | 4 | 6 | – |
| Reading, . . . | 2 | – | 9 | – | 7 | – |
| Rehoboth, . . . | 4 | 1 | 3 | – | – | 1 |
| Revere, . . . | 1 | – | 6 | 29 | 5 | – |
| Rochester, . . . | 1 | – | – | 2 | – | 1 |
| Royalston, . . . | 1 | 2 | 3 | 5 | 2 | – |

| CITY OR TOWN. | 1906. |  | 1907. |  | Increase. | Decrease. |
|---|---|---|---|---|---|---|
|  | Killed or died. | Negative. | Killed or died. | Negative. |  |  |
| Salem, | 3 | – | 1 | 2 | – | 2 |
| Sandisfield, | – | – | – | 4 | – | – |
| Saugus, | – | – | 1 | – | 1 | – |
| Seekonk, | 2 | 1 | 2 | – | – | – |
| Sharon, | 1 | – | – | – | – | 1 |
| Shrewsbury, | 2 | – | 5 | 13 | 3 | – |
| Somerville, | 38 | 5 | 33 | 49 | – | 5 |
| Southborough, | – | – | 1 | – | 1 | – |
| Springfield, | – | 1 | – | 3 | – | – |
| Sterling, | 4 | 2 | – | 1 | – | 4 |
| Stoneham, | 2 | – | 1 | – | – | 1 |
| Stoughton, | – | – | – | 1 | – | – |
| Sturbridge, | – | – | 1 | – | 1 | – |
| Swampscott, | 2 | 2 | 1 | 3 | – | 1 |
| Tewksbury, | 1 | 1 | – | 1 | – | 1 |
| Tyringham, | – | – | – | 1 | – | – |
| Upton, | 1 | – | – | – | – | 1 |
| Wakefield, | 6 | 2 | 4 | 1 | – | 2 |
| Walpole, | 2 | 5 | 1 | – | – | 1 |
| Waltham, | 1 | 3 | 2 | – | 1 | – |
| Watertown, | 5 | 1 | 6 | 28 | 1 | – |
| Webster, | – | – | – | 1 | – | – |
| Wellesley, | 3 | 1 | 1 | – | – | 2 |
| Wenham, | – | – | 1 | – | 1 | – |
| Westborough, | – | – | 1 | – | 1 | – |

| CITY OR TOWN. | 1906. |  | 1907. |  | Increase. | Decrease. |
|---|---|---|---|---|---|---|
|  | Killed or died. | Negative. | Killed or died. | Negative. |  |  |
| West Boylston, . . | – | 1 | 1 | – | 1 | – |
| Westminster, . . | – | – | 3 | 1 | 3 | – |
| Weston, . . . | – | – | 1 | 1 | 1 | – |
| Westwood, . . . | 3 | – | 1 | 10 | – | 2 |
| Weymouth, . . . | 2 | 2 | 9 | 4 | 7 | – |
| Whitman, . . . | 1 | 1 | – | – | – | 1 |
| Wilbraham, . . . | – | 1 | – | 2 | – | – |
| Wilmington,. . . | – | – | – | 2 | – | – |
| Winchendon . . | 1 | 3 | 1 | 1 | – | – |
| Winchester, . . . | 4 | – | – | – | – | 4 |
| Winthrop, . . . | 1 | 2 | 5 | 10 | 4 | – |
| Woburn, . . . | 3 | 2 | 2 | – | – | 1 |
| Worcester, . . . | 44 | 12 | 40 | 20 | – | 4 |
| Worthington, . . | – | – | – | 1 | – | – |
| Wrentham, . . . | – | 2 | – | 1 | – | – |
| Totals, . . . | 570 | 295 | 711 | 463 | – | – |

At the close of 1906, 2 horses remained upon the books as undisposed of. These were animals that had reacted to mallein in a stable test, and were later released after being retested and ceasing to react.

At the close of 1907 there are 26 cases undisposed of; only 1 of these is a horse quarantined on suspicion of having glanders, the other 25 being all horses in stable tests that have reacted and are being held for retests. The large number of animals dealt with during the year and the large proportion released are due to the number of stable tests that have been undertaken.

During 1907 a number of prosecutions have been instituted against persons for selling horses with glanders, knowing or having reasonable cause to believe that they had a contagious disease; or for removing an animal, knowing or having reasonable cause to believe it had a contagious disease; or for breaking quarantine, — convictions being obtained in most cases. In Haverhill early in the summer a physician was prosecuted for selling a horse with glanders, and the court found him not guilty. In July a Jew in Somerville was prosecuted for removing a horse which the local inspector of animals had quarantined. The court found him guilty, but let him off by placing the case on file, as the man claimed he did not understand English, and did not know he was doing wrong.

In October a Cambridge man pleaded guilty to removing a horse, knowing or having reasonable cause to believe that it had farcy. The case was placed on file, as the man said he did not mean to do anything illegal, and only returned the horse to a dealer in Pawtucket, where he bought it, in order to have his money returned. The horse was later killed by the Rhode Island Cattle Commission.

In Lawrence, in October, two men were in court for selling a glandered horse, one a stable keeper, the other the proprietor of an auction stable. The horse was bought at auction in Lowell August 15 by the stable keeper, who took it home to Lawrence, where he kept it five days and then put it into an auction room to be sold. The court found the stable keeper guilty, and fined him $50, as he had the horse long enough to find out what ailed it; but found the auctioneer not guilty, as it did not appear that he knew enough about the animal to suspect that it had a contagious disease.

An Italian horse trader in Woburn was in court in that city in October for selling a horse with glanders, in July. The court found him guilty, and fined him $100. He appealed, and appeared in the Superior Court in Cambridge in December, where he pleaded guilty, and was fined $25. The horse he sold came from the same auction room in Lowell as the horse that figured in the previous case, and the Italian owned him only four or five days when he disposed of him.

Several cases of glanders have been disposed of by this same firm of auctioneers in Lowell during the past year, whose establishment seems to be a Mecca for dealers in a cheap class of horses.

In the tenth semiannual report reference was made to a case in Quincy, where a Jew cow dealer was fined $75 for breaking quarantine, and $25 for removing a cow, knowing or having reasonable cause to believe that it had tuberculosis. The defendant appealed, and later appeared before the Superior Court in Dedham, where he pleaded *nolo contendere,* and was fined $25 on the count charging him with removing an animal with a contagious disease, and the other count was placed on file.

As in the previous year, it was necessary in several instances to employ a detective to procure the evidence and get it into shape in order to prepare the cases to present in court.

One human death from glanders is said to have occurred during the year, a case having been recently reported from the Boston City Hospital.

Mallein has been used more extensively in making stable tests during the past year than in 1906, as shown in the following table: —

*Stable Tests with Mallein.*

| CITY OR TOWN. | Number killed before making Test. | Number in Stable, First Test. | Released on First Test. | Released on Second Test. | Released on Subsequent Tests. | Killed after First Test. | Months covered by Tests. | Largest Number of Tests. | Held for Further Tests. |
|---|---|---|---|---|---|---|---|---|---|
| Bedford, | 2 | 15 | 13 | – | 1 | 1 | 5 | 4 | – |
| Berlin, | 2 | 3 | 1 | 2 | – | – | 1½ | 2 | – |
| Brookline, | 2 | 62 | 35 | 19 | – | 2 | – | – | 6 |
| Cambridge, | 3 | 66 | 31 | 23 | 2 | 1 | – | – | 9 |
| Grafton, | 2 | 15 | 14 | – | 1 | – | 3 | 3 | – |
| Fall River, | 1 | 6 | 4 | – | 2 | – | 5 | 4 | – |
| Lynn, | 6 | 8 | 1[1] | – | 2 | – | – | – | 5 |
| Lynn, | 4 | 15 | 11 | 3 | – | 1 | 1½ | 2 | – |
| Malden, | 3 | 3 | 2 | – | – | 1 | – | 1 | – |
| Revere, | 2 | 30 | – | 13 | 15 | 2 | 9 | 8 | – |

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[1] Killed by owner because of laminitis; autopsy showed no sign of glanders.

*Stable Tests with Mallein* — Concluded.

| CITY OR TOWN. | Number killed before making Test. | Number in Stable, First Test. | Released on First Test. | Released on Second Test. | Released on Subsequent Tests. | Killed after First Test. | Months covered by Tests. | Largest Number of Tests. | Held for Further Tests. |
|---|---|---|---|---|---|---|---|---|---|
| Royalston, . . . . . | 2 | 6 | 4 | 1 | 1 | – | 3 | 3 | – |
| Shrewsbury, . . . . | 2 | 16 | 7 | 1 | 5 | 3 | 7 | 5 | – |
| Somerville, . . . . . | 3 | 37 | 31 | 5 | 1 | – | 3 | 3 | – |
| Somerville, . . . . . | 1 | 10[1] | 4 | 1 | – | 1 | – | – | 3 |
| Watertown, . . . . | 3[2] | 26 | – | 26 | – | – | 1 | 2 | – |
| Westwood, . . . . . | 1 | 12 | 10 | – | – | – | – | – | 2 |
| Winthrop, . . . . . | 2 | 8 | – | – | – | 1[3] | – | – | – |
| Totals, . . . . . | 41 | 338 | 168 | 94 | 30 | 13 | – | – | 25 |

[1] One sick and not tested; died soon after, of pneumonia.

[2] One horse was killed after first stable test; was not tested with others, on account of sickness.

[3] Only one test made, as an accommodation.

It will be seen from the above table that mallein has been used in 17 stables, located in 15 cities and towns; that 41 cases of glanders were reported from these stables before making the test; that the disease has been eradicated from 11, the work is as yet unfinished in 5, and that at the last stable on the list only 1 test has been made.

There is not the slightest doubt but what glanders in Massachusetts could be very materially decreased and nearly eradicated in a few years' time, if one law applied to the whole State, and a policy was pursued of testing every horse in a stable where glanders was found, holding all reacting horses in quarantine, with permission to use as usual, provided no clinical evidence of glanders developed, and retesting reacting animals every five or six weeks until they ceased to react or were killed.

Reports from rendering establishments, as provided for by section 111 of chapter 75 of the Revised Laws, as amended by chapter 243, Acts of 1907, continue to prove of great assistance in dealing with glanders, as a number of cases are annually reported through these channels that would otherwise escape the attention of the Chief of the Cattle Bureau.

The renderers' reports are tabulated in the accompanying table: —

*Reports of Rendering Companies, 1907.*

| Rendering Companies. | Number of Reports. | Number of Cases. | Number in Boston. | Number out of Boston. | Number outside of Boston not previously reported. |
|---|---|---|---|---|---|
| C. S. Bard, Haverhill, . . | 2 | 2 | – | 2 | 1 |
| Guy U. Barnes, Fall River, . | 1 | 1 | – | 1 | 1 |
| Fitchburg Rendering Company, | 1 | 1 | – | 1 | – |
| William S. Higgins, Saugus, . | 1 | 1 | – | 1 | 1 |
| The Home Soap Company, Millbury. | 1 | 1 | – | 1 | – |
| Lowell Rendering Company, . | 2 | 4 | – | 4 | 1 |
| Muller Brothers, North Cambridge. | 26 | 64 | – | 64 | 7 |
| James E. McGovern, Andover, | 5 | 8 | – | 8 | 1 |
| W. H. Nankervis, Marlborough, | 3 | 3 | – | 3 | – |
| New Bedford Extractor Company. | 2 | 2 | – | 2 | 2 |
| New England Rendering Company, Brighton. | 25 | 71 | 24 | 47 | 19 |
| Peabody Tallow Company, . | 8 | 11 | – | 11 | 1 |
| N. Roy & Son, South Attleborough. | 10 | 15 | – | 15 | 5 |
| Worcester Rendering Company, Auburn. | 25 | 47 | – | 47 | 13 |
| Whitman & Pratt Rendering Company, North Chelmsford. | 11 | 11 | – | 11 | 1 |
| N. Ward Company, Boston, . | 50 | 239 | 200 | 39 | 8 |
| Totals, . . . . | 173 | 481 | 224 | 257 | 61 |

It is believed that public watering troughs are an important agent in the dissemination of glanders among horses, and in cities and towns where the disease appears to be on the increase orders are issued to shut off the water supply, cleanse them thoroughly and allow them to remain empty for two or three months, and these precautions are usually followed by a diminution in the number of cases reported. There is no hardship in closing these troughs in late autumn and winter, and in summer their necessity has been given due consideration. If public watering troughs in cities and towns where glanders exist were abolished, and standpipes with faucets substituted, so that teamsters whose horses had to take long, exhausting trips could carry pails and water them in this way, it would be of great assistance in diminishing glanders.

As a means of diagnosis in obscure cases of glanders, the guinea pig test still has a value. This work has been done, as in previous years, by Dr. Langdon Frothingham at the Harvard Medical School.

In closing the portion of the report upon glanders, it would be incomplete unless a word were said in regard to epizoötic lymphangitis of horses and mules. This is a contagious disease of the horse not heretofore occurring in this country, but known in southern Europe, Finland, Africa, India, China, Japan and the Philippine Islands. In 1904 it was carried to England from South Africa. It has recently appeared in western Pennsylvania, and a bulletin relating to it has been issued by Dr. Leonard Pearson, State Veterinarian, under the name of Circular No. 8 of the State Live Stock Sanitary Board of the Commonwealth of Pennsylvania, from which this information concerning it has been taken. How it was carried to western Pennsylvania has not as yet been ascertained.

The symptoms of this disease resemble farcy, and may be easily mistaken for it. It is characterized by the formation of bunches on the legs, which later break, discharge and ulcerate. The pus from these abscesses contains the specific cause, a fungus known as the *saccharomyces farciminosus,* which may be readily detected by a microscopic examination.

Bad cases have to be killed; mild ones yield to treatment. Infected animals should be isolated and quarantined. The disease may be spread by contact between diseased and healthy horses, by bedding, stable utensils, harness, and possibly by flies. If the disease extends beyond its present limits to other States, it may become a very serious and troublesome matter.

The United States Bureau of Animal Industry will undoubtedly take steps to prevent the spread of this disease from one State to another, and the very efficient State Veterinarian of Pennsylvania will do every thing possible to eradicate it within the limits of the State. It is to be hoped that it will not extend to Massachusetts. If it should, the State law is defective for dealing with it, as section 28 of chapter 90 of the Revised Laws enumerates what diseases are to be considered as contagious within the meaning of this act. The law relating to contagious animal diseases should be so broadened as to give the Chief of the Cattle Bureau authority to cope with any disease of an apparently communicable character, whether or not it has ever appeared in this country before.

Attention has been called, in previous reports, to this defect in the law; but the Legislature has not as yet seen fit to remedy the deficiency.

## Annual Inspection of Neat Cattle, Farm Animals, and Premises upon which the Former are kept.

Late in September the following circular letter was sent to the inspectors of animals in the cities and towns of the State, together with the necessary books in which to record the results of their work, and blank forms of certificates of health to be given owners in conformance with section 18, chapter 90 of the Revised Laws: —

Commonwealth of Massachusetts,
Cattle Bureau of the State Board of Agriculture,
Room 138, State House, Boston, Sept. 20, 1907.

### Directions to Inspectors of Animals.

Inspectors of animals are hereby directed to make a general inspection of the neat stock in their respective towns, and incidentally other farm animals, to commence October 1 and to be completed before the fifteenth day of November, as required by chapter 90 of the Revised Laws.

Wherever inspectors examine animals and find them free from contagious disease they will give owners certificates of health, as provided for in section 18 of the law, from the book of blanks (Form No. 2) furnished for that purpose. Books will also be provided (Form No. 1) for carrying out the provisions of sections 17 and 24 of chapter 90 of the Revised Laws.

Inspectors will not say on any report, "Same as last year," but will make a full and complete report on every place inspected, including all dimensions and measurements provided for on the blank, and answer in full all the questions as to the light, ventilation, sanitary surroundings and water supply, as well as the number of cattle kept in each stable, and give complete list of other animals in places provided for in book.

Inspectors of animals are not to quarantine any cattle as tuberculous unless they show sufficient evidence of disease to make it possible to condemn them on a physical examination. The only exception to be made is in case a milch cow shows evidence of tuberculosis of the udder; such an animal can be quarantined and the duplicate notice sent to this office.

It is also requested that, if cases of tuberculosis in animals are found, inspectors keep a record of them for a few days, and then when animals are quarantined several can be quarantined at once and duplicates sent here, so that the agent of the Cattle Bureau can see a number at one visit, instead of having to go every two or three days to see one animal at a time, thus avoiding running up expenses as much as possible.

It is also the duty of inspectors of animals to quarantine cattle brought into this State from without the limits of the Commonwealth, if the owner has not had a permit from this Bureau, the same to remain in quarantine until this office is furnished with a satisfactory certificate of tuberculin test.

Inspectors of animals are reminded that tuberculosis among cattle is not the only contagious disease with which they are called upon to deal, but in case they suspect the presence of any contagious disease among any species of domestic animals, they are to quarantine such animals and send duplicates to the Cattle Bureau office, in accordance with the provisions of section 19 of chapter 90 of the Revised Laws. Rabies is just now very prevalent in various parts of the State; and glanders and farcy is a dangerous disease, over which a constant surveillance must be exercised.

Section 28 of chapter 90 of the Revised Laws provides as follows: "Contagious diseases, under the provisions of this chapter, shall include glanders, farcy, contagious pleuro-pneumonia, tuberculosis, Texas fever, foot-and-mouth disease, rinderpest, hog cholera, rabies, anthrax or anthracoid diseases, sheep scab and actinomycosis."

As section 24 requires that the results of the inspection shall be incorporated in the annual report of the Chief of the Cattle Bureau to the State Board of Agriculture, it will be seen that it is necessary for the returns to be at this office by November 15, in order to prepare them for publication.

The necessary books for the inspection will be forwarded at once by mail. Please report immediately if not received by October 1.

AUSTIN PETERS,
*Chief of Cattle Bureau.*

The following table embodies a condensed report of the doings of the inspectors of animals in making the annual inspection, which complies with the requirements of section 24, chapter 90, Revised Laws: —

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC., REQUIRED BY SECTION 24, CHAPTER 90, REVISED LAWS.

| CITY OR TOWN. | Number Herds inspected. | Number Neat Cattle inspected. | Number Milch Cows inspected. | Number Herds kept Clean and in Good Condition. | Number Sheep inspected. | Number Swine inspected. | Number Goats inspected. | Number Stables inspected. | Number Stables well located. | Number Stables well lighted. | Number Stables well ventilated. | Number Stables kept Clean. | Number Stables with Good Water Supply. | Number Stables improved since Last Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Abington, | 106 | 336 | 271 | 103 | 4 | 56 | 3 | 110 | 96 | 33 | 13 | 94 | 109 | 2 |
| Acton, | 106 | 1,137 | 721 | 104 | 2 | 116 | – | 123 | 122 | 112 | 122 | 120 | 119 | 30 |
| Acushnet, | 133 | 595 | 445 | 121 | – | 204 | 3 | 133 | 132 | 103 | 116 | 107 | 123 | 14 |
| Adams, | 94 | 989 | 597 | 85 | 126 | 524 | – | 105 | 51[1] | 39[1] | 49[1] | 64[1] | 63[1] | 1 |
| Agawam, | 183 | 1,538 | 1,027 | 180 | 3 | 486 | 5 | 206 | 178 | 190 | 185 | 199 | 205 | 24 |
| Alford, | 44 | 347 | 197 | 41 | 201 | 118 | – | 48 | 29 | 37 | 46 | 47 | 48 | 2 |
| Amesbury, | 98 | 521 | 354 | 93 | 21 | 67 | – | 99 | 91 | 93 | 95 | 92 | 99 | 6 |
| Amherst, | 118 | 1,525 | 1,003 | 112 | 21 | 346 | – | 126 | 121 | 105 | 109 | 122 | 119 | 9 |
| Andover, | 168 | 1,371 | 1,050 | 160 | 3 | 531 | 2 | 181 | 177 | 156 | 174 | 173 | 176 | 7 |
| Arlington, | 66 | 156 | 147 | 65 | – | 66 | 3 | 66 | 62 | 58 | 53 | 61 | 64 | 1 |
| Ashburnham, | 117 | 601 | 364 | 93 | 58 | 244 | 1 | 120 | 107 | 82 | 97 | 95 | 86 | 15 |
| Ashby, | 127 | 780 | 467 | 100 | 1 | 236 | – | 130 | 122 | 94 | 102 | 86 | 128 | 1 |
| Ashfield, | 158 | 1,555 | 738 | 136 | 1,507 | 264 | 36 | 172 | 143 | 137 | 147 | 161 | 166 | 3 |
| Ashland, | 87 | 408 | 274 | 68 | – | 192 | 2 | 90 | 84 | 72 | 80 | 77 | 74 | 3 |
| Athol, | 134 | 731 | 478 | 104 | 64 | 215 | – | 135 | 121 | 58 | 91 | 122 | 127 | 4 |
| Attleborough, | 172 | 985 | 779 | 163 | – | 870 | – | 172 | 161 | 159 | 163 | 155 | 154 | 3 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Auburn, | 34 | 548 | 357 | 23 | – | 39 | – | 37 | 34 | 33 | 34 | 30 | 35 | 15 |
| Avon, | 60 | 188 | 159 | 44 | 10 | 71 | – | 60 | 31 | 24 | 42 | 52 | 60 | – |
| Ayer, | 25 | 131 | 81 | 25 | – | 72 | – | 27 | 26 | 25 | 27 | 25 | 27 | – |
| Barnstable, | 211 | 623 | 436 | 202 | 31 | 462 | – | 211 | 195 | 209 | 209 | 208 | 180 | – |
| Barre, | 89 | 2,051 | 1,266 | 79 | 236 | 310 | – | 102 | 97 | 86 | 99 | 91 | 100 | 27 |
| Becket, | 79 | 490 | 240 | 78 | 197 | 102 | 64 | 82 | 61 | 74 | 82 | 82 | 82 | 11 |
| Bedford, | 60 | 621 | 386 | 56 | 4 | 359 | 2 | 61 | 35 | 54 | 58 | 57 | 60 | – |
| Belchertown, | 287 | 2,004 | 1,363 | 254 | 15 | 364 | – | 313 | 284 | 281 | 310 | 305 | 312 | 11 |
| Bellingham, | 96 | 643 | 452 | 93 | – | 106 | 1 | 119 | 115 | 55 | 100 | 102 | 118 | 9 |
| Belmont, | 36 | 197 | 171 | 36 | – | 540 | – | 36 | 36 | 28 | 31 | 36 | 36 | – |
| Berkley, | 110 | 469 | 324 | 109 | 3 | 105 | – | 110 | 101 | 108 | 11 | 109 | 110 | 1 |
| Berlin, | 96 | 755 | 502 | 91 | 63 | 80 | – | 106 | 28 | 78 | 94 | 103 | 105 | 7 |
| Bernardston, | 74 | 709 | 413 | 51 | 221 | 189 | – | 79 | 76 | 47 | 61 | 67 | 66 | – |
| Beverly, | 60 | 719 | 529 | 57 | – | 65 | 3 | 62 | 55 | 52 | 60 | 59 | 59 | 4 |
| Billerica, | 142 | 905 | 627 | 127 | 1 | 514 | 2 | 142 | 138 | 123 | 124 | 119 | 130 | 3 |
| Blackstone, | 75 | 422 | 330 | 47 | – | 101 | 1 | 75 | 73 | 32 | 41 | 70 | 49 | 2 |
| Blandford, | 116 | 961 | 496 | 80 | 285 | 198 | – | 141 | 103 | 119 | 129 | 132 | 127 | – |
| Bolton, | 101 | 912 | 541 | 81 | 12 | 137 | 14 | 102 | 101 | 75 | 96 | 65 | 100 | 3 |
| Boston, | 212 | 1,022 | 921 | 209 | – | 567 | 1 | 224 | 203 | 168 | 206 | 195 | 211 | 4 |
| Bourne, | 75 | 172 | 142 | 64 | – | 10 | 4 | 75 | 74 | 75 | 75 | 75 | 75 | – |
| Boxborough, | 46 | 615 | 308 | 45 | 45 | 56 | 40 | 48 | 46 | 46 | 43 | 48 | 48 | 2 |
| Boxford, | 57 | 573 | 383 | 48 | – | 125 | – | 63 | 60 | 54 | 60 | 60 | 63 | 2 |

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[1] Incomplete report.

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

| CITY OR TOWN. | Number Herds inspected. | Number Neat Cattle inspected. | Number Milch Cows inspected. | Number Herds kept Clean and in Good Condition. | Number Sheep inspected. | Number Swine inspected. | Number Goats inspected. | Number Stables inspected. | Number Stables well located. | Number Stables well lighted. | Number Stables well ventilated. | Number Stables kept Clean. | Number Stables with Good Water Supply. | Number Stables improved since Last Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boylston, | 61 | 701 | 446 | 61 | – | 218 | 2 | 63 | 60 | 62 | 62 | 62 | 63 | 2 |
| Braintree, | 101 | 482 | 413 | 93 | – | 226 | – | 103 | 93 | 97 | 99 | 95 | 102 | 5 |
| Brewster, | 86 | 191 | 111 | 85 | 21 | 82 | – | 87 | 69 | 84 | 86 | 82 | 87 | – |
| Bridgewater, | 193 | 772 | 531 | 185 | 45 | 797 | 5 | 193 | 174 | 171 | 168 | 182 | 187 | 3 |
| Brimfield, | 101 | 822 | 542 | 92 | 29 | 95 | – | 101 | 8 | 64 | 81 | 100 | 101 | 2 |
| Brockton, | 89 | 963 | 688 | 87 | 6 | 586 | 7 | 101 | 85 | 94 | 95 | 89 | 101 | – |
| Brookfield, | 124 | 908 | 523 | 87 | 23 | 213 | – | 128 | 122 | 80 | 37[1] | 102 | 121 | 3 |
| Brookline, | 43 | 232 | 175 | 34 | – | 6 | – | 44 | 30 | 30 | 28 | 33 | 44 | 1 |
| Buckland, | 129 | 907 | 468 | 105 | 430 | 238 | 1 | 147 | 132 | 84 | 29 | 127 | 147 | 5 |
| Burlington, | 46 | 521 | 383 | 44 | – | 3,214 | – | 46 | 45 | 46 | 46 | 45 | 46 | 5 |
| Cambridge, | 26 | 135 | 130 | 25 | – | – | – | 29 | 27 | 28 | 29 | 29 | 28 | – |
| Canton, | 127 | 567 | 422 | 119 | 40 | 314 | 2 | 128 | 116 | 112 | 116 | 123 | 128 | 2 |
| Carlisle, | 63 | 606 | 431 | 40 | – | 49 | – | 64 | 62 | 47 | 51 | 48 | 62 | 1 |
| Carver, | 90 | 158 | 146 | 84 | 15 | 53 | 2 | 91 | 87 | 85 | 89 | 88 | 88 | 1 |
| Charlemont, | 67 | 665 | 380 | 65 | 220 | 115 | – | 76 | 55 | 54 | 74 | 70 | 78 | – |
| Charlton, | 139 | 1,622 | 955 | 127 | 55 | 166 | 2 | 147 | 142 | 135 | 123 | 116 | 95 | 6 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chatham, | 65 | 139 | 118 | 58 | – | 55 | 2 | 65 | 50 | 27 | 13 | 49 | 62 | 1 |
| Chelmsford, | 121 | 1,045 | 708 | 114 | – | 169 | – | 150 | 146 | 113 | 146 | 135 | 149 | 3 |
| Chelsea, | 35 | 267 | 255 | 31 | – | 73 | – | 38 | 31 | 33 | 33 | 32 | 35 | 2 |
| Cheshire, | 110 | 1,109 | 885 | 97 | 79 | 270 | 2 | 117 | 75[1] | 77[1] | 78[1] | 83[1] | 76[1] | 11 |
| Chester, | 82 | 639 | 285 | 80 | 170 | 159 | 3 | 110 | 89 | 54 | 100 | 101 | 110 | – |
| Chesterfield, | 102 | 909 | 432 | 97 | 12 | 149 | – | 128 | 98 | 68 | 119 | 123 | 127 | 2 |
| Chicopee, | 80 | 597 | 411 | 58 | 2 | 225 | – | 86 | 69 | 67 | 74 | 68 | 71 | 6 |
| Chilmark, | 56 | 312 | 113 | 56 | 2,224 | 43 | – | 50 | 47 | 30 | 49 | 49 | 49 | 4 |
| Clarksburg, | 74 | 395 | 252 | 74 | 1 | 202 | 3 | 79 | 66 | 75 | 77 | 79 | 79 | 5 |
| Clinton, | 38 | 80 | 71 | 33 | – | 40 | – | 38 | 36 | 29 | 34 | 32 | 36 | 12 |
| Cohasset, | 113 | 262 | 209 | 38 | – | 124 | – | 113 | 92 | 61 | 14 | 34 | 12 | 18 |
| Colrain, | 179 | 1,698 | 743 | 86 | 1,331 | 463 | 2 | 190 | 179 | 89 | 148 | 121 | 187 | 4 |
| Concord, | 152 | 1,605 | 1,050 | 142 | – | 818 | – | 162 | 159 | 156 | 160 | 161 | 160 | – |
| Conway, | 89 | 1,348 | 721 | 76 | 671 | 190 | – | 90 | 79 | 84 | 87 | 86 | 88 | 1 |
| Cummington, | 91 | 760 | 401 | 86 | 75 | 127 | 44 | 101 | 67 | 70 | 96 | 93 | 99 | – |
| Dalton, | 29 | 658 | 396 | 29 | 43 | 230 | – | 41 | 25 | 41 | 41 | 41 | 41 | – |
| Dana, | 68 | 336 | 185 | 67 | 11 | 101 | – | 70 | 69 | 37 | 69 | 68 | 69 | 1 |
| Danvers, | 66 | 896 | 792 | 60 | – | 15 | – | 73 | 71 | 72 | 72 | 72 | 68 | – |
| Dartmouth, | 230 | 2,178 | 1,584 | 215 | 100 | 540 | 8 | 238 | 209 | 198 | 156 | 210 | 214 | 112 |
| Dedham, | 87 | 525 | 445 | 85 | 1 | 344 | 6 | 90 | 71 | 82 | 82 | 84 | 88 | 1 |
| Deerfield, | 128 | 1,122 | 716 | 112 | 14 | 425 | 3 | 129 | 111 | 69 | 116 | 120 | 129 | 7 |
| Dennis, | 96 | 235 | 148 | 103 | – | 185 | – | 107 | 99 | 101 | 106 | 106 | 107 | 8 |

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[1] Incomplete report.

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

| CITY OR TOWN. | Number Herds inspected. | Number Neat Cattle inspected. | Number Milch Cows inspected. | Number Herds kept Clean and in Good Condition. | Number Sheep inspected. | Number Swine inspected. | Number Goats inspected. | Number Stables inspected. | Number Stables well located. | Number Stables well lighted. | Number Stables well ventilated. | Number Stables kept Clean. | Number Stables with Good Water Supply. | Number Stables improved since Last Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dighton, | 110 | 445 | 326 | 109 | 31 | 125 | 7 | 117 | 111 | 113 | 115 | 115 | 114 | 5 |
| Douglas, | 101 | 363 | 257 | 74 | – | 151 | – | 101 | 94 | 50 | 85 | 70 | 97 | – |
| Dover, | 52 | 432 | 327 | 42 | 33 | 157 | – | 54 | 48 | 54 | 52 | 53 | 54 | 1 |
| Dracut, | 79 | 1,161 | 890 | 78 | – | 467 | – | 79 | 77 | 73 | 73 | 77 | 79 | – |
| Dudley, | 114 | 1,166 | 699 | 60 | – | 155 | 1 | 115 | 99 | 57 | 48 | 52 | 86 | – |
| Dunstable, | 66 | 583 | 322 | 58 | 20 | 215 | 2 | 74 | 72 | 60 | 66 | 71 | 59 | 7 |
| Duxbury, | 113 | 343 | 259 | 95 | 26 | 112 | 1 | 114 | 99 | 92 | 94 | 97 | 67 | 1 |
| East Bridgewater, | 189 | 760 | 553 | 175 | – | 412 | 12 | 218 | 187[1] | 145[1] | 173[1] | 184[1] | 197[1] | 25 |
| Eastham, | 56 | 136 | 94 | 54 | – | 62 | – | 55 | 47 | 32 | 36 | 51 | 39 | 1 |
| Easthampton, | 108 | 773 | 548 | 101 | – | 294 | 3 | 119 | 93 | 113 | 114 | 119 | 119 | 1 |
| East Longmeadow, | 76 | 582 | 362 | 67 | 4 | 130 | – | 76 | 62 | 54 | 75 | 69 | 75 | – |
| Easton, | 150 | 772 | 577 | 150 | 6 | 68 | – | 174 | 163 | 167 | 170 | 169 | 173 | 4 |
| Edgartown, | 64 | 292 | 188 | 61 | 993 | 221 | 6 | 70 | 70 | 67 | 70 | 65 | 70 | 12 |
| Egremont, | 87 | 875 | 687 | 85 | 122 | 89 | 8 | 85 | 49 | 87 | 87 | 87 | 87 | 1 |
| Enfield, | 82 | 484 | 298 | 80 | 71 | 101 | 6 | 84 | 75 | 73 | 82 | 81 | 84 | – |
| Erving, | 37 | 143 | 113 | 35 | – | 75 | 2 | 37 | 31 | 36 | 37 | 36 | 36 | 1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Essex, | 76 | 621 | 373 | 76 | 4 | 40 | - | 79 | 69 | 74 | 73 | 71 | 75 | - |
| Everett, | 50 | 217 | 192 | 48 | - | - | - | 53 | 49 | 43 | 52 | 41 | 53 | - |
| Fairhaven, | 72 | 584 | 430 | 66 | 2 | 150 | - | 75 | 74 | 54 | 63 | 68 | 74 | 5 |
| Fall River, | 132 | 665 | 530 | 113 | 2 | 29 | - | 138 | 125 | 74 | 61 | 56 | 123 | - |
| Falmouth, | 155 | 417 | 329 | 150 | 1 | 280 | - | 156 | 137 | 121 | 136 | 152 | 150 | 1 |
| Fitchburg, | 158 | 1,022 | 694 | 128 | 1 | 279 | 3 | 164 | 128[1] | 67[1] | 66[1] | 116[1] | 133[1] | 10 |
| Florida, | 58 | 448 | 232 | 39 | 6 | 183 | - | 64 | 38 | 31 | 30 | 3 | 50 | 1 |
| Foxborough, | 136 | 564 | 365 | 133 | 8 | 229 | - | 149 | 141 | 141 | 144 | 136 | 149 | 17 |
| Framingham, | 182 | 1,513 | 1,107 | 179 | 35 | 264 | - | 198 | 182 | 194 | 194 | 194 | 194 | - |
| Franklin, | 141 | 739 | 570 | 137 | - | 41 | 1 | 159 | 148 | 148 | 156 | 153 | 157 | 6 |
| Freetown, | 104 | 323 | 223 | 92 | 24 | 111 | - | 113 | 103 | 67 | 84 | 107 | 69 | 8 |
| Gardner, | 67 | 680 | 459 | 58 | 36 | 154 | - | 68 | 64 | 46 | 49 | 55 | 68 | 1 |
| Gay Head, | 24 | 83 | 24 | 24 | - | 19 | - | 24 | 22 | 8 | 5 | 24 | 24 | - |
| Georgetown, | 73 | 331 | 190 | 71 | 33 | 93 | 2 | 72 | 69 | 58 | 69 | 61 | 71 | - |
| Gill, | 70 | 819 | 420 | 51 | 161 | 209 | - | 85 | 68 | 50 | 71 | 62 | 75 | 3 |
| Gloucester, | 96 | 580 | 528 | 83 | - | 117 | - | 104 | 98 | 60 | 53 | 65 | 32 | 14 |
| Goshen, | 38 | 367 | 154 | 22[1] | 62 | 161 | - | 46 | 28[1] | 30[1] | 34[1] | 30[1] | 31[1] | - |
| Gosnold, | 8 | 44 | 33 | 6 | 2,330 | 39 | - | 8 | 7 | 8 | 7 | 8 | 8 | 1 |
| Grafton, | 137 | 1,415 | 931 | 132 | 112 | 323 | 3 | 150 | 141 | 73 | 28 | 69 | 147 | 6 |
| Granby, | 118 | 1,441 | 1,007 | 117 | 73 | 210 | 1 | 135 | 135 | 123 | 135 | 135 | 135 | 1 |
| Granville, | 123 | 821 | 410 | 116 | 54 | 137 | - | 132 | 117 | 116 | 124 | 129 | 133 | 3 |
| Great Barrington, | 152 | 1,750 | 1,016 | 127 | 879 | 614 | 38 | 154 | 87 | 87 | 90 | 99 | 112 | 1 |

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[1] Incomplete report.

REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

| CITY OR TOWN. | Number Herds inspected. | Number Neat Cattle inspected. | Number Milch Cows inspected. | Number Herds kept Clean and in Good Condition. | Number Sheep inspected. | Number Swine inspected. | Number Goats inspected. | Number Stables inspected. | Number Stables well located. | Number Stables well lighted. | Number Stables well ventilated. | Number Stables kept Clean. | Number Stables with Good Water Supply. | Number Stables improved since Last Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Greenfield, | 100 | 923 | 694 | 33[1] | 619 | 309 | – | 115 | 107[1] | 60[1] | 50[1] | 55[1] | 109[1] | – |
| Greenwich, | 65 | 422 | 261 | 64 | – | 53 | – | 69 | 65 | 62 | 69 | 64 | 69 | 36 |
| Groton, | 137 | 975 | 559 | 108 | 81 | 137 | 13 | 142 | 135 | 109 | 131 | 117 | 95 | 1 |
| Groveland, | 65 | 349 | 230 | 58 | 51 | 141 | 2 | 69 | 69 | 51 | 68 | 53 | 69 | – |
| Hadley, | 216 | 1,863 | 1,032 | 181 | 98 | 699 | – | 273 | 228 | 177 | 249 | 235 | 253 | 11 |
| Halifax, | 68 | 185 | 135 | 67 | 7 | 35 | – | 68 | 31 | 67 | 68 | 67 | 67 | 1 |
| Hamilton, | 49 | 276 | 192 | 46 | – | 119 | – | 53 | 49 | 34 | 49 | 46 | 53 | 1 |
| Hampden, | 84 | 672 | 365 | 75 | 33 | 123 | 9 | 90 | 82 | 89 | 89 | 89 | 90 | – |
| Hancock, | 65 | 712 | 368 | 63 | 677 | 248 | – | 86 | 49 | 38 | 78 | 64 | 86 | – |
| Hanover, | 115 | 298 | 227 | 115 | 5 | 133 | 3 | 115 | 108 | 115 | 115 | 114 | 115 | 1 |
| Hanson, | 92 | 199 | 166 | 89 | – | 160 | 2 | 93 | 89 | 91 | 93 | 93 | 82 | 2 |
| Hardwick, | 124 | 2,284 | 1,306 | 117 | 178 | 219 | – | 131 | 39 | 79 | 48 | 74 | 53[1] | 1 |
| Harvard, | 139 | 1,519 | 851 | 82 | 7 | 23 | – | 146 | 146 | 106 | 127 | 100 | 122 | – |
| Harwich, | 107 | 233 | 162 | 102 | 1 | 103 | 5 | 107 | 49 | 74 | 79 | 101 | 105 | 1 |
| Hatfield, | 122 | 386 | 328 | 122 | – | 183 | – | 122 | 120 | 122 | 122 | 122 | 122 | – |
| Haverhill, | 243 | 1,467 | 1,106 | 137 | 5 | 576 | – | 246 | 189 | 117 | 102 | 196 | 196 | 34 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hawley, | 66 | 687 | 339 | 42 | 202 | 147 | – | 73 | 72 | 55 | 70 | 62 | 73 | 2 |
| Heath, | 78 | 868 | 359 | 74 | 359 | 134 | – | 93 | 63 | 92 | 94 | 90 | 93 | 3 |
| Hingham, | 157 | 630 | 423 | 153 | – | 318 | – | 163 | 135 | 152 | 153 | 160 | 162 | 1 |
| Hinsdale, | 88 | 852 | 476 | 85 | 48 | 136 | 5 | 91 | 55 | 33 | 27 | 88 | 90 | – |
| Holbrook, | 67 | 200 | 154 | 62 | – | 15 | – | 67 | 49 | 60 | 61 | 61 | 64 | – |
| Holden,[1] | 57 | 449 | 302 | 51 | – | 62 | – | 60 | 55 | 41 | 51 | 39 | 58 | 3 |
| Holland, | 31 | 197 | 77 | 31 | 49 | 60 | – | 34 | 30 | 22 | 34 | 32 | 34 | 2 |
| Holliston, | 137 | 812 | 500 | 123 | 6 | 115 | – | 137 | 119 | 104 | 96 | 107 | 133 | 3 |
| Holyoke, | 76 | 708 | 474 | 66 | – | 121 | 1 | 82 | 43 | 43 | 62 | 50 | 39 | 1 |
| Hopedale, | 29 | 101 | 84 | 27 | – | 21 | 1 | 29 | 28 | 21 | 27 | 22 | 29 | – |
| Hopkinton, | 142 | 731 | 453 | 83 | – | 182 | – | 144 | 142 | 95 | 92 | 90 | 138 | 6 |
| Hubbardston, | 117 | 902 | 525 | 115 | 6 | 166 | 78 | 117 | 108 | 111 | 112 | 114 | 115 | 2 |
| Hudson, | 59 | 434 | 278 | 55 | – | 164 | – | 59 | 57 | 55 | 51 | 52 | 56 | 3 |
| Hull, | 16 | 55 | 48 | 12 | – | 35 | – | 16 | 15 | 7 | 9 | 13 | 16 | – |
| Huntington, | 96 | 702 | 299 | 84 | 354 | 148 | – | 122 | 100 | 76 | 115 | 115 | 110 | 1 |
| Hyde Park, | 16 | 74 | 62 | 16 | – | – | – | 16 | 15 | 14 | 15 | 16 | 16 | – |
| Ipswich, | 131 | 940 | 609 | 127 | 26 | 396 | 4 | 138 | 134 | 134 | 138 | 138 | 138 | 10 |
| Kingston, | 96 | 278 | 177 | 71 | 5 | 111 | 2 | 100 | 89 | 51 | 51 | 51 | 100 | 3 |
| Lakeville, | 97 | 379 | 232 | 82 | – | 102 | 1 | 98 | 98 | 83 | 92 | 72 | 98 | 28 |
| Lancaster, | 81 | 705 | 463 | 68 | 15 | 85 | 1 | 82 | 77 | 58 | 81 | 65 | 68 | – |
| Lanesborough, | 89 | 942 | 612 | 89 | 14 | 142 | 4 | 90 | 69 | 90 | 90 | 90 | 90 | – |
| Lawrence, | 12 | 96 | 72 | 12 | – | 27 | – | 12 | 12 | 11 | 10 | 10 | 11 | – |

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[1] Incomplete report.

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lee, | 190 | 930 | 632 | 177 | 161 | 371 | 1 | 192 | 147 | 178 | 182 | 188 | 176 | 1 |
| Leicester, | 108 | 697 | 525 | 110 | 9 | 101 | - | 115 | 109 | 114 | 114 | 115 | 114 | 12 |
| Lenox, | 30 | 484 | 319 | 25 | 29 | 91 | - | 35 | 16 | 31 | 31 | 33 | 33 | 2 |
| Leominster, | 105 | 1,198 | 739 | 38 | 116 | 341 | - | 123 | 115 | 84 | 89 | 55 | 91 | 2 |
| Leverett, | 97 | 572 | 353 | 88 | 20 | 186 | - | 108 | 99 | 89 | 106 | 106 | 83 | 5 |
| Lexington, | 68 | 827 | 652 | 65 | - | 388 | 2 | 69 | 68 | 53 | 61 | 68 | 69 | 1 |
| Leyden, | 74 | 664 | 320 | 72 | 620 | 190 | - | 85 | 80 | 77 | 74 | 85 | 85 | - |
| Lincoln, | 79 | 985 | 762 | 72 | 29 | 851 | - | 82 | 67 | 68 | 71 | 72 | 81 | 1 |
| Littleton, | 83 | 1,469 | 800 | 82 | - | 98 | - | 83 | 82 | 83 | 83 | 83 | 83 | - |
| Longmeadow, | 52 | 281 | 203 | 47 | - | 458 | - | 63 | 46 | 55 | 63 | 62 | 62 | 2 |
| Lowell, | 43 | 351 | 288 | 43 | 1 | 454 | - | 43 | 34 | 33 | 35 | 36 | 43 | - |
| Ludlow, | 124 | 826 | 675 | 116 | 13 | 310 | 3 | 126 | 111 | 96 | 117 | 123 | 94 | 6 |
| Lunenburg, | 129 | 1,217 | 722 | 123 | 15 | 268 | - | 137 | 134 | 121 | 128 | 128 | 134 | 1 |
| Lynn, | 84 | 295 | 268 | 82 | - | 232 | 2 | 86 | 82 | 63 | 85 | 55 | 85 | 5 |
| Lynnfield, | 30 | 342 | 273 | 29 | - | 105 | 2 | 30 | 28 | 30 | 30 | 29 | 30 | - |
| Malden, | 21 | 146 | 144 | 14 | - | 4 | - | 24 | 18 | 12 | 11 | 17 | 24 | 2 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manchester, | 20 | 81 | 55 | 20 | – | 10 | – | 20 | 17 | 20 | 20 | 20 | 20 | – |
| Mansfield, | 119 | 425 | 292 | 104 | – | 199 | 6 | 127 | 118 | 97 | 109 | 102 | 125 | 4 |
| Marblehead, | 50 | 340 | 286 | 36 | – | 292 | 3 | 48 | 37 | 24 | 27 | 42 | 14 | 1 |
| Marion, | 51 | 172 | 127 | 42 | 1 | 203 | 2 | 51 | 49 | 33 | 34 | 34 | 51 | 1 |
| Marlborough, | 192 | 1,127 | 827 | 181 | 138 | 663 | 2 | 195 | 188 | 171 | 177 | 181 | 189 | 11 |
| Marshfield, | 144 | 445 | 306 | 143 | 5 | 215 | 3 | 150 | 117 | 111 | 132 | 145 | 146 | – |
| Mashpee, | 17 | 28 | 14 | 16 | – | 34 | – | 17 | 16 | 7 | 16 | 15 | 16 | 3 |
| Mattapoisett, | 98 | 337 | 213 | 94 | – | 216 | 18 | 98 | 95 | 77 | 85 | 82 | 97 | 9 |
| Maynard, | 37 | 186 | 117 | 27[1] | – | 254 | – | 37 | 29 | 34 | 35 | 28 | 36 | – |
| Medfield, | 68 | 574 | 373 | 66 | – | 514 | 2 | 73 | 73 | 73 | 73 | 70 | 73 | 2 |
| Medford, | 68 | 459 | 432 | 64 | – | 13 | – | 70 | 67 | 54 | 52 | 63 | 70 | – |
| Medway, | 118 | 571 | 372 | 110 | – | 91 | 1 | 124 | 114 | 108 | 108 | 89 | 124 | 15 |
| Melrose, | 31 | 115 | 95 | 25 | – | – | – | 32 | 29 | 22 | 20 | 17 | 32 | – |
| Mendon, | 91 | 565 | 346 | 83 | – | 95 | – | 99 | 99 | 64 | 84 | 77 | 98 | 4 |
| Merrimac, | 57 | 342 | 230 | 47 | 3 | 89 | – | 56 | 52 | 54 | 33 | 53 | 56 | 1 |
| Methuen, | 175 | 1,608 | 1,212 | 99 | 6 | 889 | 2 | 177 | 166 | 96 | 51 | 78 | 173 | 1 |
| Middleborough, | 334 | 942 | 675 | 325 | 1 | 532 | 10 | 336 | 326 | 334 | 335 | 333 | 335 | 9 |
| Middlefield, | 44 | 470 | 197 | 37 | 258 | 101 | 17 | 49 | 36 | 33 | 48 | 45 | 48 | 1 |
| Middleton, | 58 | 364 | 245 | 58 | 2 | 300 | 21 | 58 | 56 | 51 | 57 | 55 | 58 | 1 |
| Milford, | 144 | 441 | 333 | 131 | 2 | 246 | 10 | 144 | 135 | 104 | 99 | 111 | 143 | 3 |
| Millbury, | 131 | 1,007 | 662 | 125 | – | 223 | 21 | 145 | 128 | 139 | 140 | 122 | 144 | 8 |
| Millis, | 80 | 733 | 433 | 54 | 16 | 79 | – | 83 | 79 | 41 | 25 | 35 | 67 | 17 |

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[1] Incomplete report.

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Milton, | 117 | 792 | 649 | 117 | 47 | 252 | – | 121 | 114 | 121 | 121 | 121 | 121 | 3 |
| Monroe, | 22 | 151 | 90 | 21 | 43 | 43 | – | 22 | 18 | 21 | 22 | 22 | 21 | 1 |
| Monson, | 185 | 1,660 | 929 | 170 | 54 | 511 | 4 | 227 | 209 | 189 | 206 | 208 | 223 | 2 |
| Montague, | 152 | 848 | 434 | 123 | 172 | 344 | – | 162 | 155 | 111 | 137 | 131 | 159 | 10 |
| Monterey, | 62 | 593 | 316 | 56 | 211 | 63 | – | 89 | 58 | 63 | 78 | 83 | 89 | 3 |
| Montgomery, | 41 | 432 | 265 | 40 | 74 | 36 | – | 44 | 39 | 44 | 44 | 43 | 43 | – |
| Mount Washington, | 15 | 68 | 50 | 15 | 2 | 27 | – | 15 | 10 | 9 | 13 | 15 | 15 | 1 |
| Nahant, | 6 | 10 | 10 | 6 | – | – | – | 6 | 6 | 6 | 6 | 6 | 6 | 1 |
| Nantucket, | 55 | 476 | 309 | 52 | 128 | 140 | 9 | 55 | 53 | 52 | 54 | 55 | 55 | 2 |
| Natick, | 91 | 575 | 434 | 73 | – | 229 | – | 94 | 91 | 51 | 51 | 67 | 92 | – |
| Needham, | 100 | 650 | 506 | 97 | 11 | 8 | – | 100 | 90 | 55 | 94 | 93 | 99 | 1 |
| New Ashford, | 21 | 185 | 106 | 19 | – | 288 | 53 | – | 27 | 24 | 27 | 27 | 27 | 1 |
| New Bedford, | 69 | 512 | 385 | 67 | – | 115 | – | 69 | 69 | 61 | 69 | 69 | 69 | 1 |
| New Braintree, | 73 | 1,470 | 1,016 | 72 | – | 31 | – | 73 | 73 | 73 | 73 | 73 | 73 | – |
| Newbury, | 118 | 1,578 | 807 | 103 | 74 | 407 | – | 184 | 163 | 115 | 161 | 183 | 153 | 6 |
| Newburyport, | 79 | 504 | 328 | 70 | – | 355 | – | 80 | 80 | 71 | 68 | 76 | 80 | 4 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| New Marlborough, | 133 | 1,376 | 787 | 123 | 224 | 162 | – | 161 | 117 | 111 | 137 | 128 | 159 | 11 |
| New Salem, | 103 | 482 | 295 | 99 | 36 | 136 | – | 107 | 102 | 107 | 107 | 104 | 106 | 1 |
| Newton, | 221 | 1,248 | 1,113 | 202 | 8 | 162 | – | 232 | 181 | 195 | 215 | 188 | 226 | – |
| Norfolk, | 66 | 430 | 274 | 64 | – | 127 | – | 66 | 66 | 64 | 63 | 61 | 54 | 2 |
| North Adams, | 29 | 497 | 310 | 29 | 26 | 247 | – | 29 | 27 | 29 | 29 | 29 | 29 | 2 |
| Northampton, | 52 | 741 | 478 | 51 | – | 140 | – | 55 | 37 | 45 | 53 | 54 | 55 | – |
| North Andover, | 61 | 977 | 581 | 56 | – | 38 | – | 61 | 59 | 58 | 59 | 58 | 61 | – |
| North Attleborough, | 103 | 628 | 518 | 81 | 6 | 135 | 1 | 103 | 94 | 98 | 94 | 102 | 71 | 29 |
| Northborough, | 138 | 1,111 | 741 | 134 | 34 | 35 | – | 144 | 138 | 94 | 106 | 102 | 95 | 14 |
| Northbridge, | 83 | 550 | 331 | 84 | – | 113 | – | 90 | 85 | 79 | 85 | 79 | 90 | – |
| North Brookfield, | 139 | 1,277 | 773 | 97 | – | 127 | – | 157 | 144 | 46 | 43 | 136 | 153 | 5 |
| Northfield, | 81 | 718 | 462 | 77 | 55 | 124 | – | 81 | 81 | 68 | 81 | 78 | 81 | – |
| North Reading, | 63 | 564 | 377 | 58 | 5 | – | – | 65 | 57 | 58 | 64 | 54 | 65 | 5 |
| Norton, | 156 | 499 | 351 | 144 | 18 | 146 | – | 157 | 139 | 141 | 132 | 138 | 153 | – |
| Norwell, | 101 | 247 | 176 | 97 | 36 | 140 | – | 101 | 96 | 80 | 100 | 99 | 101 | – |
| Norwood, | 68 | 415 | 296 | 66 | – | 102 | – | 73 | 68 | 73 | 73 | 72 | 73 | 1 |
| Oak Bluffs, | 37 | 153 | 100 | 35 | 10 | 74 | – | 37 | 34 | 28 | 34 | 34 | 20 | 4 |
| Oakham, | 51 | 632 | 372 | 46 | – | 72 | – | 54 | 51 | 30 | 28 | 46 | 51 | 16 |
| Orange, | 186 | 1,061 | 692 | 175 | 41 | 350 | – | 201 | 182 | 196 | 189 | 185 | 199 | 1 |
| Orleans, | 89 | 184 | 142 | 67 | 22 | 95 | 1 | 88 | 72 | 70 | 77 | 69 | 74 | 3 |
| Otis, | 87 | 494 | 258 | 87 | 151 | 187 | – | 96 | 76 | 95 | 96 | 96 | 96 | 1 |
| Oxford, | 152 | 883 | 575 | 136 | 47 | 348 | 8 | 157 | 120 | 122 | 130 | 133 | 154 | – |

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Palmer, | 173 | 824 | 590 | 160 | – | 35 | – | 180 | 149 | 89 | 94 | 156 | 153 | 1 |
| Paxton, | 59 | 581 | 384 | 50 | 10 | 53 | – | 59 | 55 | 43 | 53 | 51 | 58 | 5 |
| Peabody, | 64 | 832 | 774 | 58 | 34 | 648 | – | 64 | 60 | 62 | 63 | 50 | 64 | 22 |
| Pelham, | 49 | 217 | 146 | 47 | – | 54 | – | 49 | 43 | 34 | 43 | 48 | 49 | 2 |
| Pembroke, | 108 | 231 | 134 | 106 | – | 88 | – | 108 | 104 | 106 | 108 | 100 | 105 | – |
| Pepperell, | 139 | 903 | 635 | 128 | 10 | 212 | – | 150 | 147 | 134 | 143 | 148 | 149 | 28 |
| Peru, | 46 | 423 | 207 | 44 | 100 | 22 | 1 | 47 | 38 | 42 | 46 | 45 | 47 | – |
| Petersham,[1] | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Phillipston, | 66 | 425 | 305 | 57 | 7 | 131 | – | 72 | 62 | 40 | 68 | 70 | 71 | 1 |
| Pittsfield, | 76 | 1,353 | 885 | 70 | 82 | 336 | 3 | 86 | 76 | 57 | 54 | 67 | 79 | 3 |
| Plainfield, | 77 | 636 | 352 | 56 | 226 | 110 | 3 | 87 | 72 | 51 | 62 | 79 | 77 | 1 |
| Plainville, | 61 | 321 | 234 | 59 | – | 78 | – | 63 | 64 | 60 | 60 | 55 | 63 | 6 |
| Plymouth, | 175 | 465 | 372 | 136 | 32 | 388 | 5 | 175 | 135 | 102 | 129 | 135 | 154 | 8 |
| Plympton, | 53 | 208 | 136 | 49 | 1 | 56 | 10 | 56 | 54 | 51 | 35 | 53 | 36 | 4 |
| Prescott, | 63 | 494 | 279 | 49 | – | 112 | – | 64 | 57 | 49 | 58 | 58 | 64 | 8 |
| Princeton, | 96 | 1,273 | 669 | 86 | 66 | 112 | 23 | 103 | 99 | 80 | 40 | 77 | 103 | 1 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Provincetown, | 10 | 90 | 68 | 9 | – | 12 | – | 10 | 9 | 9 | 4 | 9 | 5 | – |
| Quincy, | 63 | 594 | 540 | 50 | 4 | 105 | 4 | 64 | 60 | 58 | 58 | 60 | 64 | 6 |
| Randolph, | 85 | 314 | 274 | 76 | 1 | 611 | 2 | 85 | 77 | 84 | 84 | 81 | 84 | – |
| Raynham, | 110 | 505 | 375 | 107 | 9 | 205 | 1 | 112 | 108 | 88 | 106 | 106 | 110 | 19 |
| Reading, | 67 | 385 | 289 | 64 | – | 220 | – | 67 | 65 | 58 | 63 | 61 | 66 | 3 |
| Rehoboth, | 212 | 1,475 | 1,182 | 161 | 49 | 498 | 2 | 212 | 201 | 120 | 125 | 131 | 212 | 3 |
| Revere, | 28 | 219 | 208 | 28 | – | 500 | – | 29 | 24 | 28 | 24 | 28 | 25 | 7 |
| Richmond, | 82 | 594 | 369 | 82 | 492 | 192 | – | 82 | 67 | 75 | 81 | 81 | 82 | – |
| Rochester, | 114 | 330 | 233 | 108 | – | 255 | 3 | 116 | 104 | 90 | 110 | 104 | 112 | 11 |
| Rockland, | 104 | 237 | 211 | 81 | – | 232 | – | 102 | 93 | 65 | 64 | 66 | 93 | 3 |
| Rockport, | 37 | 200 | 190 | 33 | 1 | 9 | – | 37 | 35 | 29 | 31 | 36 | 32 | – |
| Rowe, | 63 | 371 | 207 | 61 | 60 | 62 | – | 65 | 59 | 60 | 64 | 62 | 59 | 3 |
| Rowley, | 74 | 643 | 384 | 67 | 15 | 117 | 8 | 76 | 76 | 49 | 59 | 53 | 67 | 3 |
| Royalston, | 112 | 710 | 345 | 103 | 59 | 177 | – | 115 | 110 | 70 | 110 | 105 | 103 | 1 |
| Russell, | 42 | 233 | 111 | 37 | 117 | 79 | – | 50 | 34[2] | 14[2] | 28[2] | 30[2] | 43 | 5 |
| Rutland, | 102 | 978 | 538 | 94 | – | 169 | – | 130 | 120 | 85 | 130 | 110 | 130 | 20 |
| Salem, | 11 | 267 | 206 | 11 | 5 | 132 | 1 | 11 | 10 | 5 | 6 | 9 | 11 | 2 |
| Salisbury, | 98 | 537 | 308 | 98 | 3 | 134 | – | 100 | 99 | 98 | 97 | 100 | 100 | 2 |
| Sandisfield, | 99 | 942 | 492 | 96 | 70 | 226 | – | 119 | 78 | 90 | 111 | 104 | 112 | – |
| Sandwich, | 90 | 279 | 184 | 90 | – | 79 | – | 90 | 79 | 89 | 89 | 89 | 89 | – |
| Saugus, | 46 | 885 | 809 | 46 | – | 152 | – | 59 | 56 | 51 | 56 | 57 | 59 | 4 |
| Savoy, | 91 | 604 | 372 | 76 | 59 | 142 | – | 99 | 81 | 37 | 47 | 84 | 81 | – |

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[1] No report.

[2] Incomplete report.

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

| CITY OR TOWN. | Number Herds inspected. | Number Neat Cattle inspected. | Number Milch Cows inspected. | Number Herds kept Clean and in Good Condition. | Number Sheep inspected. | Number Swine inspected. | Number Goats inspected. | Number Stables inspected. | Number Stables well located. | Number Stables well lighted. | Number Stables well ventilated. | Number Stables kept Clean. | Number Stables with Good Water Supply. | Number Stables improved since Last Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scituate, | 129 | 383 | 271 | 128 | 1 | 98 | 1 | 129 | 106 | 86 | 109 | 116 | 128 | – |
| Seekonk, | 139 | 1,078 | 844 | 116 | 18 | 2,177 | 57 | 150 | 131 | 105 | 137 | 114 | 88 | 6 |
| Sharon, | 77 | 302 | 237 | 75 | – | 284 | – | 80 | 65 | 67 | 75 | 75 | 63 | – |
| Sheffield, | 173 | 1,997 | 1,255 | 156 | 173 | 506 | 2 | 206 | 139 | 108 | 178 | 172 | 128 | 9 |
| Shelburne, | 106 | 1,576 | 659 | 96 | 991 | 218 | – | 109 | 90 | 99 | 108 | 106 | 109 | 7 |
| Sherborn, | 51 | 683 | 456 | 47 | 1 | 205 | 12 | 51 | 48 | 40 | 43 | 44 | 51 | 5 |
| Shirley, | 58 | 337 | 234 | 56 | 7 | 67 | – | 64 | 62 | 61 | 63 | 64 | 64 | – |
| Shrewsbury, | 116 | 1,420 | 872 | 112 | 2 | 538 | – | 118 | 110 | 105 | 106 | 110 | 112 | 2 |
| Shutesbury, | 47 | 154 | 122 | 45 | 4 | 129 | 1 | 51 | 49 | 46 | 50 | 48 | 51 | 7 |
| Somerset, | 80 | 607 | 475 | 79 | 1 | 431 | – | 86 | 69 | 83 | 86 | 83 | 75 | 3 |
| Somerville, | 32 | 83 | 77 | 27 | 1 | 168 | – | 32 | 30 | 20 | 21 | 24 | 33 | 25 |
| Southampton, | 140 | 1,169 | 650 | 140 | 64 | 233 | – | 144 | 132 | 138 | 135 | 142 | 143 | 1 |
| Southborough, | 96 | 1,167 | 931 | 92 | – | 234 | – | 106 | 106 | 90 | 93 | 97 | 104 | 4 |
| Southbridge, | 66 | 675 | 412 | 61 | 25 | 193 | – | 72 | 66 | 54 | 64 | 60 | 70 | – |
| South Hadley, | 99 | 1,166 | 906 | 106 | – | 227 | 2 | 121 | 112 | 97 | 54 | 103 | 117 | 8 |
| Southwick, | 109 | 857 | 538 | 109 | 381 | 215 | 30 | 113 | 102 | 94 | 111 | 111 | 112 | 6 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spencer, | 140 | 1,470 | 855 | 126 | 17 | 383 | 5 | 141 | 130 | 136 | 134 | 128 | 139 | 1 |
| Springfield, | 126 | 503 | 387 | 84 | 17 | 1,270 | 1 | 128 | 86 | 56 | 73 | 77 | 70 | – |
| Sterling, | 140 | 1,720 | 1,080 | 118 | 173 | 188 | 1 | 148 | 137 | 81 | 106 | 114 | 144 | 3 |
| Stockbridge, | 97 | 812 | 530 | 73 | 334 | 280 | 4 | 106 | 64 | 50 | 55 | 88 | 102 | 9 |
| Stoneham, | 74 | 338 | 287 | 60 | – | 339 | – | 78 | 36 | 28 | 28 | 55 | 52 | 4 |
| Stoughton, | 112 | 431 | 298 | 92 | – | 52 | 7 | 114 | 104 | 76 | 99 | 80 | 112 | 1 |
| Stow, | 93 | 845 | 490 | 15 | – | 172 | 22 | 109 | 107 | 51 | 58 | 34 | 102 | 3 |
| Sturbridge, | 57 | 602 | 311 | 45 | 1 | 160 | – | 59 | 57 | 39 | 42 | 44 | 48 | – |
| Sudbury, | 67 | 1,102 | 721 | 54[1] | – | 315 | 2 | 79 | 24 | 76 | 76 | 74 | 76 | – |
| Sunderland, | 66 | 795 | 432 | 15 | 18 | 423 | – | 72 | 70 | 33 | 30 | 25 | 59 | 7 |
| Sutton, | 152 | 1,257 | 764 | 125 | 25 | 362 | – | 162 | 155 | 71 | 71 | 47 | 158 | 7 |
| Swampscott, | 22 | 75 | 67 | 21 | – | 12 | – | 22 | 18 | 19 | 18 | 19 | 22 | – |
| Swansea, | 119 | 915 | 699 | 118 | 2 | 704 | – | 124 | 123 | 114 | 123 | 124 | 124 | 2 |
| Taunton, | 147 | 848 | 685 | 144 | 19 | 391 | – | 148 | 139 | 148 | 148 | 148 | 148 | 1 |
| Templeton, | 138 | 684 | 419 | 140 | – | 270 | – | 147 | 140 | 118 | 130 | 135 | 146 | 3 |
| Tewksbury, | 110 | 798 | 543 | 100 | – | 285 | 3 | 117 | 111 | 66 | 90 | 85 | 103 | 2 |
| Tisbury, | 24 | 58 | 54 | 23 | – | 42 | – | 23 | 17 | 20 | 20 | 23 | 22 | 5 |
| Tolland, | 41 | 390 | 222 | 35 | – | 63 | – | 58 | 44 | 49 | 58 | 56 | 58 | – |
| Topsfield, | 69 | 598 | 408 | 60 | 2 | 193 | 3 | 79 | 67 | 57 | 59 | 55 | 61 | 3 |
| Townsend, | 116 | 403 | 282 | 112 | – | 128 | – | 116 | 113 | 101 | 106 | 109 | 111 | 6 |
| Truro, | 61 | 229 | 173 | 59 | – | 54 | – | 61 | 43 | 61 | 61 | 61 | 61 | 2 |
| Tyngsborough, | 65 | 392 | 290 | 65 | 21 | 340 | – | 67 | 64 | 40 | 45 | 67 | 66 | – |

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[1] Incomplete report.

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Continued.*

| CITY OR TOWN. | Number Herds inspected. | Number Neat Cattle inspected. | Number Milch Cows inspected. | Number Herds kept Clean and in Good Condition. | Number Sheep inspected. | Number Swine inspected. | Number Goats inspected. | Number Stables inspected. | Number Stables well located. | Number Stables well lighted. | Number Stables well ventilated. | Number Stables kept Clean. | Number Stables with Good Water Supply. | Number Stables improved since Last Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tyringham, | 51 | 511 | 279 | 49 | 207 | 164 | – | 71 | 71 | 51 | 71 | 70 | 71 | 5 |
| Upton, | 97 | 580 | 368 | 60 | – | 272 | – | 105 | 98 | 67 | 59 | 76 | 95 | 8 |
| Uxbridge, | 130 | 898 | 511 | 130 | 41 | 238 | 57 | 136 | 132 | 126 | 129 | 133 | 133 | 3 |
| Wakefield, | 78 | 353 | 280 | 72 | 3 | 374 | 3 | 87 | 77 | 85 | 85 | 81 | 87 | 17 |
| Wales, | 53 | 238 | 139 | 30 | 99 | 76 | – | 56 | 49 | 43 | 53 | 55 | 36 | 1 |
| Walpole, | 105 | 552 | 463 | 101 | – | 383 | 3 | 106 | 65 | 67 | 76 | 79 | 80 | 1 |
| Waltham, | 41 | 665 | 478 | 36 | – | 836 | – | 41 | 39 | 37 | 38 | 37 | 41 | – |
| Ware, | 75 | 613 | 378 | 69 | 3 | 165 | 16 | 75 | 69 | 70 | 74 | 67 | 74 | 10 |
| Wareham, | 54 | 164 | 134 | 47 | 28 | 41 | – | 54 | 53 | 46 | 52 | 49 | 53 | – |
| Warren, | 131 | 1,734 | 906 | 128 | 34 | 209 | – | 150 | 134 | 92 | 4 | 141 | 133 | 10 |
| Warwick, | 67 | 297 | 183 | 52 | 25 | 102 | – | 70 | 59 | 65 | 66 | 69 | 56 | – |
| Washington, | 54 | 632 | 264 | 47 | 559 | 190 | 3 | 73 | 42[1] | 31[1] | 63[1] | 64[1] | 62[1] | 1 |
| Watertown, | 52 | 320 | 292 | 48 | 10 | 232 | 4 | 57 | 51 | 26 | 36 | 45 | 56 | 2 |
| Wayland, | 73 | 679 | 553 | 73 | – | 1,030 | 1 | 76 | 59 | 73 | 74 | 76 | 73 | 2 |
| Webster, | 30 | 231 | 178 | 29 | – | 22 | – | 29 | 30 | 28 | 27 | 29 | 30 | 1 |
| Wellesley, | 71 | 291 | 244 | 70 | – | 1 | 3 | 71 | 64 | 42 | 69 | 69 | 71 | 1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wellfleet, | 35 | 93 | .67 | 30 | - | 30 | - | 35 | 34 | 34 | 35 | 32 | 34 | 3 |
| Wendell, | 59 | 226 | 100 | 57 | 12 | 137 | 1 | 61 | 55 | 45 | 11 | 59 | 55 | 7 |
| Wenham, | 49 | 306 | 257 | 45 | - | 162 | - | 50 | 36 | 41 | 41 | 45 | 50 | 1 |
| Westborough, | 133 | 1,716 | 1,081 | 130 | 7 | 659 | - | 139 | 117 | 113 | 121 | 120 | 125 | 15 |
| West Boylston, | 90 | 942 | 621 | 87 | 22 | 422 | - | 113 | 111 | 107 | 112 | 109 | 113 | 41 |
| West Bridgewater, | 76 | 794 | 578 | 50 | 11 | 118 | 2 | 78 | 70 | 35 | 54 | 56 | 37 | 1 |
| West Brookfield, | 91 | 1,436 | 697 | 52[1] | 29 | 336 | 23 | 110 | 107 | 26 | 39 | 70 | 106 | 15 |
| Westfield, | 212 | 1,443 | 862 | 208 | 20 | 639 | 4 | 236 | 208 | 235 | 235 | 235 | 235 | - |
| Westford, | 105 | 1,064 | 652 | 105 | - | 208 | - | 108 | 107 | 92 | 102 | 64 | 108 | 7 |
| Westhampton, | 57 | 559 | 313 | 50 | - | 172 | - | 66 | 44 | 30 | 59 | 47 | 61 | 1 |
| Westminster, | 100 | 670 | 455 | 97 | 31 | 2 | - | 102 | 97 | 58 | 9[1] | 88 | 101 | 4 |
| West Newbury,[1] | 37 | 549 | 320 | 37 | 7 | 56 | 5 | 57 | 54 | 55 | 56 | 44 | 57 | 8 |
| Weston, | 89 | 818 | 610 | 89 | 37 | 221 | - | 98 | 91 | 94 | 96 | 86 | 98 | 1 |
| Westport, | 307 | 1,480 | 1,036 | 273 | - | 473 | 2 | 317 | 296 | 173 | 249 | 273 | 306 | 4 |
| West Springfield, | 131 | 829 | 595 | 129 | - | 615 | - | 131 | 121 | 128 | 128 | 128 | 131 | 7 |
| West Stockbridge, | 111 | 521 | 351 | 102 | 150 | 236 | - | 111 | 82 | 94 | 89 | 93 | 102 | 1 |
| West Tisbury, | 59 | 220 | 160 | 59 | 751 | 65 | - | 59 | 29 | 59 | 59 | 54 | 59 | - |
| Westwood, | 62 | 555 | 349 | 58 | - | 296 | - | 70 | 66 | 69 | 69 | 68 | 70 | 1 |
| Weymouth, | 174 | 709 | 610 | 113 | 5 | 207 | 6 | 174 | 142 | 97 | 90 | 81 | 164 | 2 |
| Whately, | 106 | 897 | 467 | 105 | 2 | 248 | - | 128 | 127 | 118 | 128 | 125 | 128 | 1 |
| Whitman, | 89 | 393 | 296 | 85 | 21 | 261 | 2 | 89 | 75 | 80 | 84 | 80 | 89 | 6 |
| Wilbraham, | 104 | 843 | 457 | 84 | - | 228 | - | 128 | 112 | 94 | 119 | 103 | 120 | 2 |

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[1] Incomplete report.

## REPORT OF INSPECTION OF ANIMALS, STABLES, ETC. — *Concluded.*

| CITY OR TOWN. | Number Herds inspected. | Number Neat Cattle inspected. | Number Milch Cows inspected. | Number Herds kept Clean and in Good Condition. | Number Sheep inspected. | Number Swine inspected. | Number Goats inspected. | Number Stables inspected. | Number Stables well located. | Number Stables well lighted. | Number Stables well ventilated. | Number Stables kept Clean. | Number Stables with Good Water Supply. | Number Stables improved since Last Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Williamsburg, | 82 | 719 | 359 | 72 | 45 | 115 | – | 82 | 72 | 35 | 60 | 72 | 72 | – |
| Williamstown, | 191 | 1,484 | 966 | 132 | 1,167 | 768 | 3 | 191 | 167 | 87 | 85 | 169 | 186 | 8 |
| Wilmington, | 98 | 322 | 224 | 98 | 1 | 368 | 8 | 99 | 95 | 74 | 86 | 88 | 95 | 1 |
| Winchendon, | 131 | 768 | 488 | 126 | 14 | 337 | – | 134 | 117[1] | 110[1] | 115[1] | 120[1] | 121[1] | 3 |
| Winchester, | 32 | 226 | 190 | 30 | – | 52 | – | 32 | 24 | 23 | 26 | 27 | 30 | 2 |
| Windsor, | 90 | 852 | 447 | 90 | 64 | 218 | 1 | 108 | 86 | 106 | 107 | 107 | 96 | – |
| Winthrop, | 10 | 30 | 28 | 10 | – | – | – | 11 | 11 | 11 | 11 | 11 | 11 | 1 |
| Woburn, | 73 | 309 | 247 | 65 | – | 194 | 3 | 73 | 54 | 49 | 49 | 46 | 72 | – |
| Worcester, | 306 | 2,119 | 1,738 | 303 | 41 | 4,140 | 4 | 306 | 291 | 302 | 303 | 302 | 304 | 12 |
| Worthington, | 102 | 899 | 509 | 100 | 118 | 174 | 4 | 105 | 78 | 96 | 104 | 103 | 104 | 4 |
| Wrentham, | 70 | 249 | 182 | 37 | – | 99 | – | 70 | 65 | 25 | 15 | 41 | 44 | 2 |
| Yarmouth, | 52 | 134 | 108 | 46 | 17 | 64 | – | 52 | 48 | 46 | 47 | 48 | 51 | 3 |
|  | 32,937 | 237,647 | 155,876 | 29,272 | 27,080 | 84,252 | 1,089 | 34,959 | 30,601 | 26,837 | 28,780 | 30,141 | 32,485 | 1,566 |

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[1] Incomplete report.

It will be seen by the above table that the inspectors of animals examined 237,647 head of neat cattle, of which 155,876 were milch cows, as compared with 247,288 head of neat cattle, of which 164,396 were milch cows, reported the previous year. The reports of the inspectors of animals, if correct, would indicate a decrease of nearly 10,000 head of neat cattle in a year; and, as there is a decrease of nearly 10,000 milch cows reported, it would seem that the decrease was almost entirely confined to this class of animals. Much depends upon the correctness of the work of the inspectors, and some of them may not have made as careful and complete an inspection as in the previous year, but there may have been a diminution in the number of milch cows kept, and if a fact, it is due to the increased cost of grain and labor and the difficulty of obtaining competent willing farm hands, especially good milkers. If the milking machine prove to be a success, so as to come into general use, it will help solve the labor problem.

If farmers raised more grain in New England and cultivated more land it would help to solve the feed problem; but this cannot be done when industrial conditions are such as to render labor scarce and high, as shops and factories furnish shorter hours and in many instances higher pay.

Another factor that may have had something to do with the decrease in the number of milch cows, provided there be really a decrease, may be the requirements of boards of health; these, with the increased cost of grain and labor, without a corresponding increase in the price the farmer receives for milk, cannot have been without some effect.

The inspectors seem to have examined fewer sheep and more swine than in the year previous. They also report inspecting nearly 800 fewer herds of cattle than the year before. It would seem, therefore, that a part of the falling off in the number of cattle reported is due to a less thorough inspection than in 1906.

## TUBERCULOSIS.

The work connected with bovine tuberculosis can, as in preceding years, be classified under three divisions.

*First.* — That part of the work connected with the examination of cattle quarantined by the local inspectors of animals, or reported by owners as suspected of having tuberculosis, which have to be examined by agents, who destroy or advise releasing the animals, as in their judgment the cases require.

*Second.* — The quarantine work required by the law, and the regulations of the Cattle Bureau for preventing the introduction of bovine tuberculosis from other States.

*Third.* — "Voluntary request work."

The following figures show what has been done under the first division: —

*Massachusetts Cattle.*

| | | |
|---|---|---|
| Number released, | 723 | |
| Number condemned, killed and paid for, | 1,418 | |
| Number permit to kill, and paid for, | 60 | |
| Number permit to kill, no award, | 301 | |
| Number died in quarantine, no award, | 80 | |
| Number condemned and killed, in process of settlement, | 401 | |
| Number in quarantine, unsettled, | 2 | |
| Total Massachusetts cattle quarantined, | | 2,985 |

*Cattle from without the State.*

| | | |
|---|---|---|
| Number released, | 92 | |
| Number condemned and killed, no award, | 314 | |
| Number died in quarantine, no award, | 3 | |
| Number condemned, killed, no lesions found (6 of which have been paid for, 4 in process of settlement), | 10 | |
| Total, including 308 Brighton cattle held for retest, | | 419 |
| Total number cattle quarantined, | | 3,404 |

Among the Massachusetts cattle quarantined, 38 were tested to satisfy the owners as to the presence or absence of disease; of these, 24 were condemned and killed and 14 were released.

Of the 324 condemned and killed on suspicion of being tuberculous, brought into Massachusetts from without the State, 215 were tested and retested at Brighton, and the remaining 109 were tested at other places. Ten were found to show no lesions of tuberculosis, for which the State reimburses owners. These were all tested at points outside of Brighton.

Of the animals tested and retested at Brighton and condemned, 90 were rendered and 125 passed for beef.

The work under the second division is given below, showing the receipts of animals at the stock yards, the number of cattle tested at Brighton, the number of neat cattle brought into the State on permits or without, the number allowed to come in with certificates of test and the number tested after arrival.

*Receipts of Stock at the Watertown Stock Yards, from Dec. 1, 1906, to Nov. 30, 1907.*

| | |
|---|---|
| Vermont cattle, | 5,560 |
| New Hampshire cattle, | 4,947 |
| New York cattle, | 3,304 |
| Massachusetts cattle, | 2,522 |
| Western cattle, | 29,065 |
| Sheep and lambs, | 4,461 |
| Swine, | 4,128 |
| Calves, | 36,572 |

*Receipts of Stock at the New England Dressed Meat and Wool Company's Yards at Somerville, from Dec. 1, 1906, to Nov. 30, 1907.*

| | |
|---|---|
| Maine cattle, | 2,118 |
| New Hampshire cattle, | 1,875 |
| Vermont cattle, | 5,811 |
| Massachusetts cattle, | 1,514 |
| Western cattle, | 71,385 |
| Sheep and lambs, | 315,380 |
| Swine, | 1,138,644 |
| Calves, | 54,967 |

Cattle not for immediate slaughter have been tested by the agent of the Cattle Bureau at Brighton, and are included in the Brighton report.

*Receipts of Stock at Brighton, from Dec. 1, 1906, to Nov. 30, 1907.*

| | |
|---|---|
| Maine cattle, | 9,490 |
| New Hampshire cattle, | 1,611 |
| Vermont cattle, | 2,104 |
| New York cattle, | 5,562 |
| Massachusetts cattle, | 11,376 |
| Western cattle, | 54,534 |
| Sheep and lambs, | 15,423 |
| Swine, | 15,645 |
| Calves, | 31,621 |
| Cattle tested, | 14,480 |
| Cattle condemned after test, | 169 |
| Cattle killed on permit to kill, | 49 |
| Cattle released after test, | 14,262 |

*Report of Cattle brought into State during the Year, to Points outside of the Quarantine Stations.*

| | |
|---|---|
| For dairy and breeding purposes, tested before shipment, | 2,616 |
| For dairy and breeding purposes, tested after arrival, | 4,622 |
| | 7,238 |
| Neat cattle on which no test was required, outside of cattle and calves for immediate slaughter, | 1,078 |
| Total, | 8,316 |

The cattle and calves on which no test was required, outside of animals for immediate slaughter, were as follows: —

| | |
|---|---|
| Returned from out-of-State pastures, | 801 |
| Calves under six months old, | 262 |
| Injured on route and killed by owner, | 3 |
| Died before test could be made, | 3 |
| Unloaded in transit through State, | 6 |
| Pastured in State for brief period only, | 3 |
| Total, | 1,078 |

The number of cattle and calves brought into the State for immediate slaughter cannot be given exactly, as there were several carloads in which the number of head was not reported definitely. In round numbers there were 7,500 cattle and calves brought in on permits for immediate slaughter.

Nearly all of the total number of animals given above were brought in on permits issued by the Chief of the Cattle Bureau, only 434 head having been brought in without permits, which were reported to this Bureau by railroad agents, local inspectors or others. Of these, 53 were accompanied by satisfactory certificates of tuberculin test, 5 were calves under six months old, 28 were slaughtered at once for beef, 7 were returned from pasture, and the remainder, 341 head, were tested by agents of the Cattle Bureau. There was also 1 herd brought into the State for exhibition without permit, which was duly reported to this Bureau.

There were 1,002 permits issued, 158 of which were not used. Seven permits were issued allowing cattle to be brought into the State for exhibition at agricultural fairs, to remain for a short time only; 5 were issued for bringing cattle back from exhibition in other States. Ten permits were issued for pasturing cattle in the State during the season; 1 permit was given for returning cattle daily from a pasture in Connecticut; 1 permit was given to unload cattle near the border line, to be driven into the next State; 3 permits were given to load Massachusetts cattle at stations just over the line, as a matter of convenience for the shipper; and several permits were given to one owner whose barn is just over the line in New Hampshire, to bring Massachusetts cattle in as sold.

Nearly 1,200 more cattle were tested and released at Brighton during 1907 than in the previous year, and there was an increase of over 200 head that were released at points outside. There was also a larger proportion tested after arrival at points outside of Brighton than in the previous year. Most of these animals were milch cows.

The third portion of this work, or "voluntary request work," is shown in the appended list: —

| | | |
|---|---|---|
| Number of herds tested, | | 16 |
| Number of animals tested, | | 454 |
| Number condemned and rendered, | 26 | |
| Number condemned and passed for beef, no award, | 126 | |
| Number released, | 300 | |
| Cases undecided, | 2 | |
| | | 454 |

This is the same number of herds as in 1906, but includes more animals, with a larger per cent of reactions. Some herds were found to be absolutely healthy, in others there was a very large percentage found to be diseased. It is gratifying to find, however, that in herds that have been tested in previous years the animals as a rule are generally free from tuberculosis, and the herds where a large per cent are diseased are those that have not been previously tested.

Several of the herds where tests have been made on voluntary request are the property of State institutions. The advisability of the Cattle Bureau doing this work is questionable; furnishing an agent and paying for animals that are rendered from its appropriation is too much like a man doing business by taking money out of one pocket and putting it into another. While it seems proper perhaps for the Cattle Bureau to furnish a skilled veterinarian with tuberculin for this work, it would be better to let the Legislature make a special appropriation for each institution to replenish its herd when there was any loss in it from tuberculosis.

There seems to be a continued interest in the immunization of calves from tuberculosis by the Von Behring method. There are a number of herds in the State where the young animals are being immunized, and thus far the results seem to be very encouraging. This method will be particularly valuable in pure-bred herds in which tuberculosis exists, where it is undesirable to kill the parent stock, many members of which may be but slightly diseased, yet where the young animals would grow up in a scrofulous condition if it were not for this means of conferring upon them immunity from disease.

When Koch discovered the tubercle bacillus in 1882, he announced that it was identical in animals and man. This, if true, would make the milk from tuberculous cows very dangerous as an article of human food, if used in an uncooked state, as milk usually is.

Dr. Theobald Smith, however, in 1896–98 demonstrated the existence of two types of tubercle bacilli, — the bovine derived from cattle, and the human found in the sputum of persons suffering from phthisis. When Koch's attention was called to the result of Dr. Smith's investigations, he took the matter up and agreed with him in the correctness of his views, and went so far as to say, in a speech at the Congress of Tuberculosis in London, in July, 1901, that there is absolutely no danger to the public health from tuberculous cattle. This view was going from one extreme to the other. It seems more reasonable to take a middle course, and assume that, while the danger was over-estimated a few years ago, still there is a slight danger, and delicate persons and young children are sometimes infected with the bovine form of tubercle bacillus through the medium of milk, and that when thus infected the disease may in some instances prove fatal.

Dr. Smith has found the bovine form of tubercle bacillus in the tonsils and lymphatic glands from persons in several instances, and in some cases fatal results may occur.

To determine just how great the danger from the use of raw milk from tuberculous cows to human beings may be will require a great many examinations of tuberculous lymph nodes and autopsies; but while the per cent of danger may not be very great, there is positively a certain amount of risk. It is a well-known fact that the milk from cows with tuberculosis of the udder or from those that show marked clinical evidence of disease is very infectious to calves, pigs and small experimental animals, and it is certainly very undesirable to use such milk for feeding children. Milk may become infected in various ways. A cow with a tuberculous udder may excrete the tubercle bacilli directly in the milk, or one with generalized tuberculosis may have a few bacilli pass off through the milk, or the milk may become contaminated through the dust of the stable or the dirt falling from the cows' flanks into the pail.

Cows with phthisis do not cough up and expectorate infectious material, like the human animal, but swallow what they raise and pass it off through the digestive canal. Recent observations show that the fæces of cattle with sufficient lung disease to cough up and swallow infective material are literally teeming with millions of tubercle bacilli. When such a cow lies down, her tail becomes contaminated with the filth of the gutter, and when she swings it she smears her flanks and sides with manure containing tubercle bacilli; some of this dirt gets into the pail at milking time, and some goes into the floating dust of the air. Here is an added argument for clean stables and clean cows.

While the present methods of the Cattle Bureau take the cows that show physical evidence of disease, or that may have tuberculous udders, and thus help to give the State a fair system of dairy inspection as far as tuberculosis is concerned, there still remains what has been recently described in a bulletin of the United States Department of Agriculture, Bureau of Animal Industry, "The unsuspected but dangerously tuberculous cow." (United States Department of Agriculture, Bureau of Animal Industry, Circular No. 118.) This circular, by Dr. E. C. Schroeder, superintendent of the Experiment Station, describes a class of cow, and gives cases, where the animal, although apparently healthy from a physical point of view, is found to be in such a condition as to be a source of danger to other cattle and the public health.

Beside the danger to human beings from the use of products from tuberculous cows, particularly from milk and dairy products, which may not be so very great, there remain the great losses to the stock breeder and dairyman from the ravages of this disease among their animals, which would make its eradication seem desirable for the protection of their pocketbooks, instead of giving rise to a lot of stupid, short-sighted opposition. It is not only proving a loss because of the neat cattle destroyed by it, but is causing heavy losses to swine raisers, because the hogs that are kept in cellars under infected cattle, or fed their milk at home or at the creamery, become tuberculous and are then condemned when sent to the abattoir.

Last year between 21,000 and 22,000 head of cattle were brought into this State for dairy and breeding purposes, over 18,000 of which were tested after arrival by agents of the Cattle Bureau; the rest, only a little over 2,500, were tested by veterinarians outside of the State, and it is believed that most of these were honestly tested. That is, a number of cattle, mostly milch cows, are brought into the State annually, equal to over 10 per cent of the cows of the State. If every farmer when he buys a new cow would disinfect the stalls where the old ones stood, and then buy only tested cows to replace the old ones, there would be much less tuberculosis than there is to-day among the milkmen's herds in eastern Massachusetts; but, as it is, many of these healthy cows are taken to infected barns and later sold to the State or the bologna sausage maker because they have gone to pieces with tuberculosis. The average milkman will buy any good-looking cow he sees on the Brighton market, and does not seem to care whether she is a healthy tested cow from without the State or an untested Massachusetts cow.

If the appropriations of the Cattle Bureau permitted, it would be well to test with tuberculin all the cattle offered for sale on the Brighton market, killing all reacting animals, then trace every reacting Massachusetts cow back to the herd in the western part of the State from which she came, clean up the herd, disinfect the barn, and then have the owner understand that if any more cases of tuberculosis ever occurred on his farm he would forfeit his right to compensation from the State in the future. If in addition owners of fancy herds where there is tuberculosis would systematically immunize the calves, bovine tuberculosis, with its attendant porcine tuberculosis, could be rapidly diminished. It would take more money to do this than present appropriations permit of, but it would pay in the end.

During the last three or four years a monthly report has been sent to the United States Department of Commerce and Labor, giving a list of the receipts of cattle, calves, sheep, lambs, swine and horses at Boston. The following table shows the animals received during the twelve months ending Nov. 30, 1907. These figures include the cattle and sheep intended for export, as well as those to be slaughtered at the abattoirs around Boston, and the milch cows for sale to farmers. Boston is quite a distributing point for horses that are sold at the sales stables to go into cities and towns surrounding Boston, as well as into some of the other New England States.

*Receipts of Live Stock at Boston for Twelve Months ending Nov. 30, 1907.*

| For Month ending — | Cattle. | Calves. | Sheep and Lambs. | Swine. | Horses. |
|---|---|---|---|---|---|
| Dec. 26, . . . . | 16,305 | 8,385 | 28,762 | 134,240 | 1,815 |
| Jan. 30, . . . . | 17,363 | 10,357 | 28,135 | 100,176 | 2,385 |
| Feb. 27, . . . . | 16,660 | 9,497 | 25,766 | 81,883 | 1,938 |
| Mar. 27, . . . . | 13,974 | 12,418 | 19,001 | 72,935 | 1,990 |
| Apr. 30, . . . . | 19,222 | 15,997 | 21,127 | 98,467 | 2,520 |
| May 29, . . . . | 16,943 | 16,577 | 17,386 | 86,178 | 2,063 |
| June 25, . . . . | 14,742 | 15,801 | 23,331 | 77,628 | 2,042 |
| July 30, . . . . | 16,877 | 12,429 | 34,681 | 130,549 | 2,125 |
| Aug. 27, . . . . | 17,016 | 10,872 | 24,736 | 87,168 | 2,059 |
| Sept. 30, . . . . | 19,107 | 12,366 | 35,059 | 103,215 | 1,725 |
| Oct. 31, . . . . | 21,381 | 11,390 | 34,680 | 86,316 | 2,020 |
| Nov. 26, . . . . | 19,292 | 9,904 | 48,296 | 66,813 | 1,525 |
| Total, . . . . | 208,882 | 155,993 | 338,960 | 1,125,568 | 24,207 |

The number of horses received for the last six months of the year was not ascertained in time to send the figures to Washington, owing to the sad and untimely death in August of Mr. A. D. Phelps, Mr. Dennen's able and faithful assistant; but these figures have since been made up by his successor, and are included in the table in order to make the statistics complete.

## MISCELLANEOUS DISEASES.

In addition to rabies, glanders and bovine tuberculosis, there have been a number of outbreaks of various diseases usually classified in these reports under the heading of "miscellaneous," such as hog cholera, black leg, actinomycosis and tuberculosis among swine. Where outbreaks of hog cholera or swine plague have occurred, the usual course has been pursued of quarantining the piggery until the sick pigs died or recovered and the owner disinfected the premises. In outbreaks where there have been good-sized pigs, ready for the shambles, the owners have been allowed to send them to the slaughterhouse, subject to the usual inspection.

A number of outbreaks of symptomatic anthrax or black leg have occurred in Worcester, Hampshire and Berkshire Counties. When this disease appears in a pasture an agent is sent to inoculate the exposed young cattle with blacklegoids for those owners who desire it. Young cattle given this protective inoculation do not develop the disease, and no more deaths from it are reported among animals in these pastures after being given the treatment.

Several cases of actinomycosis have been reported among cows. Animals that are emaciated and suffering with open discharging sores on the jaw bones, or with actinomycosis of the udder, are killed; those but slightly diseased and in good condition are released, with the advice to the owner to dry off and fatten as rapidly as possible, and then to dispose of the creature for beef.

There has been a little trouble from verminous bronchitis in sheep in Franklin County, but it does not seem to have been very serious, and is not a contagious disease within the meaning of section 28, chapter 90, Revised Laws.

A supposed outbreak of a contagious disease in a herd of cows at Boxborough last July was investigated by an agent of the Cattle Bureau, who ascertained that four animals had died. The cause of death was decided to be poisoning from eating nitrate of soda that was bought for fertilizing purposes, and left where the cattle could lick it.

The last of May or early in June four cows died on a farm in Taunton. The farm was visited by the Chief of the Cattle Bureau and Dr. A. G. Walker of Taunton, who reported the cases. It seemed as though the animals must have been poisoned in some way, and it was thought that possibly sheep laurel might have been the poisonous agent, as quantities of it grew in the pasture where the cattle were kept. A cow was taken there and tied up and given a diet of sheep laurel for two weeks, and appeared to thrive on it. The cause of death still seems to be a mystery.

A number of supposed cases of poisoning have been heard of during the past summer from cows grazing under trees which had been sprayed with arsenate of lead; but just how great is the danger of being poisoned in this way, needs further investigation.

Last spring there was an outbreak of what is known as "calf diphtheria" among some valuable Holstein calves in Princeton. A specimen of the larynx of a calf was sent to the laboratory for examination. Dr. Frothingham pronounced the disease to be what is known as calf diphtheria. This malady is not due to the bacillus of diphtheria which produces that disease in the human family. It is called calf diphtheria because of the formation of a necrotic membrane in the throat, which somewhat resembles the false membrane found in human diphtheria. The owner was advised to put the calves, as they were born, in a different stable, thoroughly disinfect the stable where the disease had been, and keep the healthy calves away from the sick ones. There has been no further complaint of the trouble on the farm where it appeared. The owner states that for treatment he used peroxide of hydrogen as a wash for the mouth and throat.

## FINANCIAL STATEMENT.

At the end of the fiscal year, Nov. 30, 1906, there was on hand, as per tenth semiannual report: —

| | | |
|---|---|---|
| Balance of appropriation for salaries and expenses for 1906, . . . . | $892 84 | |
| Balance of appropriation for general work of Bureau for 1906, . . . | 9,528 61 | |
| Appropriated under chapter 197, Acts of 1907, for deficiency in 1906 account, . | 8,432 60 | |
| | | $18,854 05 |
| Appropriation for salaries and expenses of 1907, under chapter 60, Acts of 1907, | $7,000 00 | |
| Appropriation for general work of Bureau for 1907, under chapter 123, Acts of 1907, . . . . . . . | 70,000 00 | |
| | | 77,000 00 |
| Total to be accounted for, . . . . . | | $95,854 05 |

| | | |
|---|---|---|
| Expended during the year: — | | |
| For 542 head of cattle condemned and killed during the year 1906, paid for in 1907, . . . . . . . | $11,193 25 | |
| For 1,488 head of cattle condemned and killed during the year, . . . . | 31,133 35 | |
| For killing, burial and arbitration expenses, . . . . . . . | 206 00 | |
| For services of agents (exclusive of glanders work), . . . . . | 14,933 32 | |
| For expenses of agents (exclusive of glanders work), . . . . . | 5,705 28 | |
| For expenses of quarantine stations, . | 7,323 23 | |
| For expenses of glanders work, including services and expenses of agents, laboratory work and killing and burial, . | 7,073 47 | |
| For laboratory work (exclusive of glanders work), . . . . . | 4,022 00 | |
| For implements, ear tags, thermometers, etc., . . . . . . . | 616 75 | |
| For salary of Chief of Bureau, . . | 1,800 00 | |
| For salary of clerk, . . . . . | 1,200 00 | |
| For salaries of assistant clerks and stenographers, . . . . . . | 2,239 64 | |
| For office expenses, printing, postage, stationery, etc., . . . . . | 1,721 29 | |
| For expenses of Chief of Bureau, . . | 169 84 | |
| Total expenditures, . . . . | | 89,337 42 |
| Balance from all accounts, Nov. 30, 1907, . . | | $6,516 63 |

| | | |
|---|---|---|
| This balance is made up of the following items: — | | |
| Unexpended balance of appropriation for salary and expense account of 1906, . | $399 80 | |
| Unexpended balance of deficit appropriation for account of 1906, . . . | 616 69 | |
| Unexpended balance of appropriation for salary and expense account of 1907, . | 412 92 | |
| Unexpended balance of appropriation for general work of Bureau and available for unsettled accounts of 1907, . . | 5,087 22 | |
| Total as above, . . . . | | $6,516 63 |

| | | |
|---|---|---|
| There are unpaid bills chargeable to appropriation for salaries and expenses, amounting to . . . . . . | $540 86 | |
| The balance of this appropriation is . | 412 92 | |
| Deficit on this account, . . . . | | $127 94 |
| There are unpaid miscellaneous bills, amounting to . . . . . . | $1,686 05 | |
| Unsettled claims for 334 head of cattle, condemned and killed as tuberculous, amounting to . . . . . . | 7,266 15 | |
| Total of outstanding accounts, . | $8,952 20 | |
| Balance of appropriation available for payment of same, . . . . . | 5,087 22 | |
| Deficit on account of this appropriation, . . . . . . . | | 3,864 98 |
| Total amount of deficit,. . . . . . . | | $3,992 92 |

| | |
|---|---|
| From the sale of hides and carcasses of condemned cattle, the sale of ear tags, testing cattle at Brighton for non-resident owners, etc., there has been received and paid into the State treasury, . . . . . . . | $4,730 91 |
| The average price paid for condemned cattle during the year was . . . . . . . . . | $20 85 |

It will be seen by the foregoing statement that a balance of $5,087.22 was left on hand November 30, from the appropriation for the general work of the Cattle Bureau for 1907, available for payment of all unsettled accounts. When all the claims against the Cattle Bureau come in, this sum will not be sufficient, and there will probably be a deficit of about $3,500.

The Legislature of 1907 passed a deficiency appropriation bill for the Cattle Bureau of $8,432.60, which is a much larger sum than will be needed this year to settle the unpaid accounts of 1907.

Estimates made to the Auditor under the requirements of chapter 211, Acts of 1905, for the fiscal year ending Nov. 30, 1908, are for $77,000, divided into $7,000 for the salaries of the Chief of the Cattle Bureau and his clerk, extra clerical assistance, printing, postage and general office and incidental expenses, and $70,000 for the general outside work in exterminating contagious diseases among horses and other animals.

This estimate is based on the assumption that the appropriations made in 1907 for the use of the Cattle Bureau were sufficient to meet nearly all its expenses for the current year; and if the policy of the State toward contagious diseases of animals is to continue the same as for the last few years, there is no necessity for asking for more money. If any more extensive work is to be undertaken, then of course an additional appropriation would be necessary to meet the expense of any additional work.

Respectfully submitted,

AUSTIN PETERS,
*Chief of Cattle Bureau.*

# SEVENTEENTH ANNUAL REPORT

OF THE

# DAIRY BUREAU

OF THE

# MASSACHUSETTS BOARD OF AGRICULTURE,

REQUIRED UNDER

CHAPTER 89, SECTION 12, REVISED LAWS.

JANUARY 15, 1908.

# DAIRY BUREAU—1907.

CARLTON D. RICHARDSON, WEST BROOKFIELD, *Chairman.*
JOHN M. DANFORTH, LYNNFIELD CENTRE.
HENRY E. PAIGE, AMHERST.

*Secretary.*

J. LEWIS ELLSWORTH, *Executive Officer and Secretary of the State Board of Agriculture.*

*General Agent.*

P. M. HARWOOD.

ADDRESS, ROOM 136, STATE HOUSE, BOSTON.

# REPORT.

Each year brings with it changed conditions and results in new and varying work. We have found less violations of the renovated butter law and an increase in violations of the oleomargarine laws. This is accounted for by the fact that fewer dealers are now handling the former, while the number handling the latter has increased. It is believed that the amount of oleomargarine sold in the State has somewhat increased, although the Boston receipts show a falling off of nearly 2,000 packages. As the oleomargarine now on the market is not prohibited by State law, as was the case with that formerly sold, the various laws governing registration of dealers, the marking of vehicles, the labelling of packages, placing of signs, and, above all, the selling of oleomargarine as and for butter, are the only means of protecting the public against fraud, and the butter makers and dealers against unfair competition. We have presented in court, during the year, 101 cases of violation of the various oleomargarine laws, 79 cases of violation of the renovated butter law and 18 cases for the adulteration of milk. Two of the cases were for milk containing formaldehyde ; the balance were undoubtedly watered. Most of this milk work has been done in conjunction with the local milk inspectors.

We have during the year come into closer touch with these officers than ever before, and have gathered from them information which has aided us materially in our work, for which we record our indebtedness. We notice that in places where the campaign for pure milk has waged longest and much high-priced milk is sold the rate of consumption of milk per capita is high. This is encouraging, and shows what can be accomplished by furnishing consumers with a good article. It is the assurance that milk is clean and right that counts in obtaining the confidence of the public, thus increasing consumption, especially after the consumer has become accustomed to paying the higher price. It is along these lines that those in authority are working, and we trust that the assurance of improved quality and condition of milk now being produced in this State will increase the consumption still further in the near future, and that the price to the farmers will soon be such as will fairly recompense them for its production.

The milk standard question was agitated before the Legislature last winter, and several bills were offered by interested parties, but none prevailed. We are of the opinion that the day will some time come when milk will be sold on its merits, and that fat content will be the measure of its commercial value. We also believe that some way should be provided to permit the legal sale of any and all milk produced by healthy, properly fed and well-cared-for cows. We do not believe that the present milk standard law is right, in so far as it calls for too wide a variation between summer and winter milk. It would perhaps be better not to have any variation at all. We are decidedly of the opinion that milk from other States should be subject to all the requirements as to its production which prevail in this State.

Elsewhere will be found a list of the prosecutions and some interesting analyses of market milk as it is being produced to-day, and also figures illustrative of adulterated and unadulterated milk.

We are glad to note an increase in the price of milk, indicative of better conditions for the dairyman. What is needed to-day perhaps more than ever before is confidence and co-operation between all parties concerned in the milk business. If all will pull together, more milk will be consumed, a better price paid and the producers properly remunerated. Care must be taken, however, that no legislation is allowed that will make the producer worse off than he is at present.

The personnel of the Bureau and its staff has remained unchanged. J. M. Danforth was reappointed by Governor Guild, C. D. Richardson has continued as chairman, H. E. Paige as a member, J. Lewis Ellsworth secretary, P. M. Harwood general agent, A. W. Lombard agent, B. F. Davenport and H. C. Emerson chemists, and four persons have been temporarily employed as agents during some part of the year.

The summary of the year's work is as follows: —

| | |
|---|---|
| Total number of inspections, . . . . . . . | [1] 5,779 |
| Number of inspections where no sample was taken, . . . | 4,538 |
| Number of samples of butter and oleomargarine, nearly all purchased, . . . . . . . . . . | 1,182 |
| Number of samples of milk and cream, mostly purchased, . | 192 |
| Cases in court, . . . . . . . . . . | 202 |
| Meetings addressed by chairman of the Bureau, . . . . | 17 |
| Meetings addressed by the general agent, . . . . . | 27 |

Cases prosecuted during the eleven months ending Nov. 30, 1907, by months and courts, with law violated, and results, are as follows: —

| COURT. | Month. | Number. | Law violated. | Convicted. | Discharged. |
|---|---|---|---|---|---|
| Worcester, . | January, . | 12 | Oleomargarine, . | 12 | – |
| Pittsfield, . | January, . | 4 | Renovated butter, . | 4 | – |
| North Adams, | January, . | 11 | 9 oleomargarine, 2 renovated butter. | 11 | – |
| Boston, . . | January, . | 5 | Renovated butter, . | 5 | – |
| Lowell, . . | February, . | 18 | 4 renovated butter, 14 oleomargarine. | 18 | – |
| Boston, . . | February, . | 4 | Renovated butter, . | 4 | – |
| Lawrence, . | February, . | 4 | Renovated butter, . | 4 | – |
| Chicopee, . | February, . | 4 | Oleomargarine, . | 4 | – |
| Taunton, . | March, . | 8 | 2 renovated butter, 6 oleomargarine. | 8 | – |
| New Bedford, . | March, . | 16 | Renovated butter, . | 15 | 1 |

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[1] There were 133 extra samples taken during inspections, therefore this number is 133 less than the sum of the next three items.

| COURT. | Month. | Number. | Law violated. | Convicted. | Discharged. |
|---|---|---|---|---|---|
| Worcester, | March, | 3 | Milk, | 3 | – |
| Boston, | March, | 4 | Renovated butter, | 4 | – |
| Springfield, | March, | 3 | Renovated butter, | 3 | – |
| Northampton, | March, | 2 | Renovated butter, | 2 | – |
| Holyoke, | March, | 8 | Renovated butter, | 8 | – |
| Boston, | April, | 2 | Oleomargarine, | 2 | – |
| Lynn, | April, | 9 | 4 oleomargarine, 5 renovated butter. | 9 | – |
| Beverly, | April, | 4 | Oleomargarine, | 4 | – |
| Holyoke, | April, | 19 | Oleomargarine, | 17[1] | – |
| Springfield, | April, | 2 | Oleomargarine, | 2 | – |
| Worcester, | April, | 2 | Milk, | 2 | – |
| Worcester, | May, | 4 | Oleomargarine, | 4 | – |
| Southbridge, | May, | 3 | Oleomargarine, | 3 | – |
| Worcester, | June, | 1 | Milk, | 1 | – |
| Worcester, | August, | 3 | Milk, | 3 | – |
| Woburn, | August, | 1 | Milk, | 1 | – |
| Worcester, | September, | 1 | Milk, | 1 | – |
| Chicopee, | October, | 2 | Milk, | 2 | – |
| Salem, | October, | 6 | Milk, | 6 | – |
| Wareham, | October, | 10 | 4 renovated butter, 6 oleomargarine. | 10 | – |
| Fall River, | November, | 12 | Oleomargarine, | 12 | – |
| New Bedford, | November, | 6 | Oleomargarine, | 6 | – |
| Quincy, | November, | 5 | 4 oleomargarine, 1 renovated butter. | 5 | – |
| Dedham, | November, | 2 | Renovated butter, | 2 | – |
| Malden, | November, | 2 | Renovated butter, | 2 | – |
| Totals, | | 202 | | 199 | 1 |

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[1] Two cases nol-prossed by agreement, defendant paying $100 fine on another complaint.

NOTE. — The milk cases in Worcester were prosecuted in conjunction with G. L. Berg, in Chicopee with C. W. King, in Salem with J. J. McGrath, and in Woburn with P. T. McDonough; and the renovated butter work in Boston with James O. Jordan. The Bureau is also indebted to the milk inspectors of Worcester, Lowell, Lynn, Holyoke, Chicopee, Springfield, Northampton, Greenfield and Taunton for valuable assistance in oleomargarine and milk work.

The charges in the several cases in court for the year ending Nov. 30, 1907, have been as follows: —

| | |
|---|---|
| Selling renovated butter in unmarked packages, | 79 |
| Selling oleomargarine in imitation of yellow butter, | 4 |
| Selling oleomargarine without sign on exposed contents, | 7 |
| Selling oleomargarine when butter was asked for, | 22 |
| Selling oleomargarine without being registered, | 10 |
| Selling oleomargarine without sign in store, | 17 |
| Selling oleomargarine in unmarked packages, | 12 |
| Selling oleomargarine from wagon without license, | 3 |
| Selling oleomargarine from wagon not bearing the words "licensed to sell oleomargarine,". | 7 |
| Selling oleomargarine from restaurant without notice to guests, | 23 |
| Selling milk containing formaldehyde, | 2 |
| Selling milk containing added water, | 14 |
| Selling milk below standard,[1] | 2 |
| | 202 |

The following is a list of inspections without samples and the number of samples taken in the years 1903–1907, inclusive: —

| YEAR. | Inspections without Samples. | Samples taken. |
|---|---|---|
| 1903, | 4,135 | 1,395 |
| 1904, | 4,456 | 1,157 |
| 1905, | 4,887 | 971 |
| 1906, | 4,985 | 576 |
| 1907, | 4,538 | 1,374 |
| Totals, | 23,001 | 5,473 |
| Averages, | 4,600+ | 1,096+ |

---

[1] This milk was undoubtedly adulterated, but was entered as above for convenience.

The following is a list of the number of cases entered in court and also the number of convictions secured in the years 1903–1907, inclusive: —

| Year. | Total Cases. | Convictions. |
|---|---|---|
| 1903, | 289 | 272 |
| 1904, | 168 | 166 |
| 1905, | 155 | 155 |
| 1906, | 113 | 110 |
| 1907, | 202 | 199 |
| Totals, | 927 | 902 |
| Average cases, | 185+ | |
| Average convictions, | . . | 180+ |

## OLEOMARGARINE.

For the first time we are able to report that there are no licenses taken out in this State for the sale of colored oleomargarine, and no case has been discovered during the year where oleomargarine which contained foreign "coloration," "which caused it to look like yellow butter," has been sold. There are, however, upon the market several brands of oleomargarine which look like yellow butter, apparently made so by the ingredients which they contain. The wording of our statute seems to many to prohibit the sale of even such goods, but our Superior Court judges rule otherwise. The United States government officials also allow such goods to be made and sold upon the payment of the one-fourth cent tax, as uncolored oleomargarine. So strongly impressed were we that the wording of our statute prohibited the sale of these goods that we took a sample from a prominent wholesale dealer and attempted to make a test case of it for decision by the Supreme Court. The dealer and the manufacturers were agreeable to this, and an agreed statement of fact was drawn up by their counsel and the district attorney of Worcester County; but the presiding judge (Brown), supported by a previous decision by Judge Bishop, which had been endorsed by several other Superior Court judges, overruled the attempt, and the matter stands just where it did before. If this sort of oleomargarine is to be sold in this State, then it becomes necessary, in order to safeguard the consuming public as well as the dairy interests, that all laws regulating the sale of the same shall be rigidly enforced. This we have done, and 101 violations have been found and the cases have been entered in court during the past year.

The output of oleomargarine in the United States for the year ending June 30, 1907, was greater than at any time since the enactment of the last national oleomargarine law, but is still far below that of the years previous to its enactment. The appended statistics tell the story : —

| | Pounds. |
|---|---|
| *Under New Law.* | |
| 1907, | 68,988,850 |
| 1906, | 53,146,657 |
| 1905, | 49,880,982 |
| 1904, | 48,071,480 |
| 1903, | 71,804,102 |
| *Under Old Law.* | |
| 1902, | 126,316,472 |
| 1901, | 104,943,856 |
| 1900, | 107,045,028 |

The licenses issued in this State have also increased, being as follows : —

| | |
|---|---|
| Retail, uncolored, | 229 |
| Wholesale, uncolored, | 17 |
| Total, | 246 |

The Boston oleomargarine receipts were 14,581 packages for the year 1907, — a decrease of 19,131 packages from the previous year.

## Renovated Butter.

It is an interesting fact that the sales of renovated butter have apparently fallen off in this State. We are at a loss to account for this, unless it be that the price of renovated butter, which only follows a few cents behind creamery butter, has been carried at too high a point, those who were obliged to use lower-priced goods using a cheaper grade of butter or oleomargarine instead. There is but one factory license issued in this State. The number of cases in court this year for violation of the renovated butter law was 79. The output of the renovated butter factories of the United States for the year ending June 30, 1907, was 62,919,998 pounds.

### BUTTER.

The price of butter has ruled higher than for many years, which was natural, and in conformity with the general advance of prices and the advanced cost of milk production. We believe that the quality of butter upon the market is slowly but surely improving. A more intelligent care of the dairy and more skill in the use of the starter by the butter maker are undoubtedly to a large extent responsible for this. High prices, however, are not conducive to the increase of volume of business, and the Boston supply has fallen considerably below that of 1906. This is apparently largely due to the decrease in export trade, for there is still a balance of 224,464 pounds, representing the increased local consumption, — a figure much below that of last year.

The winter meeting of the Massachusetts Creamery Association was the most enthusiastic and successful held for some years. The quality of the butter exhibited showed improvement. The association is harmonious, and progressive.

The average price paid per pound of butter fat by the local creameries to patrons, so far as reported, was 30.79+ cents.

The following table shows the average quotation for the best fresh creamery butter in a strictly wholesale way in the Boston market for the last eight years: —

| | 1907.<br>Cents. | 1906.<br>Cents. | 1905.<br>Cents. | 1904.<br>Cents. | 1903.<br>Cents. | 1902.<br>Cents. | 1901.<br>Cents. | 1900.<br>Cents. |
|---|---|---|---|---|---|---|---|---|
| January, . | 30.4 | 25.2 | 28.0 | 22.7 | 28.0 | 25.0 | 25.0 | 29.5 |
| February, . | 31.7 | 25.2 | 31.6 | 24.6 | 27.0 | 28.5 | 25.0 | 26.0 |
| March, . . | 30.2 | 25.5 | 28.0 | 24.1 | 27.0 | 29.0 | 23.0 | 27.0 |
| April, . . | 32.2 | 22.2 | 29.1 | 21.6 | 27.5 | 32.0 | 22.0 | 21.0 |
| May, . . | 31.4 | 19.9 | 23.9 | 19.9 | 22.5 | 25.0 | 19.5 | 20.5 |
| June, . . | 24.3 | 20.2 | 20.7 | 18.4 | 22.75 | 23.5 | 20.0 | 20.5 |
| July, . . | 25.9 | 21.0 | 20.6 | 18.3 | 20.5 | 22.5 | 20.0 | 20.5 |
| August, . . | 26.0 | 23.8 | 21.6 | 19.1 | 20.0 | 21.5 | 21.0 | 22.0 |
| September, . | 29.2 | 25.6 | 21.2 | 20.8 | 22.0 | 23.5 | 22.0 | 22.5 |
| October, . | 29.9 | 26.9 | 22.1 | 21.5 | 22.5 | 24.5 | 21.5 | 22.0 |
| November, . | 27.1 | 27.6 | 23.0 | 24.1 | 23.5 | 27.0 | 24.0 | 25.0 |
| December, . | 27.5 | 30.7 | 23.9 | 25.7 | 24.5 | 28.5 | 24.5 | 25.5 |
| Averages, . | 28.48 | 24.48 | 24.47 | 21.73 | 26.23 | 25.0 | 22.3 | 23.5 |

The Chamber of Commerce figures regarding the butter business in Boston for 1906 and 1907 are as follows: —

| | 1907.<br>Pounds. | 1906.<br>Pounds. |
|---|---|---|
| Carried over, . . . . . . . | 6,851,825 | 10,189,575 |
| Receipts for January, . . . . . | 2,652,155 | 3,530,291 |
| Receipts for February, . . . . . | 2,669,598 | 2,848,633 |
| Receipts for March, . . . . . . | 2,731,791 | 3,367,031 |
| Receipts for April, . . . . . . | 3,504,867 | 2,427,304 |
| Receipts for May, . . . . . . | 5,339,155 | 5,856,768 |
| Receipts for June, . . . . . . | 8,559,668 | 8,603,945 |
| Receipts for July, . . . . . . | 10,711,647 | 9,238,974 |
| Receipts for August, . . . . . . | 8,703,341 | 8,778,101 |
| Receipts for September, . . . . . | 6,778,041 | 6,688,729 |
| Receipts for October, . . . . . . | 5,982,162 | 6,983,522 |
| Receipts for November, . . . . . | 3,302,617 | 3,990,993 |
| Receipts for December, . . . . . | 2,654,185 | 2,838,032 |
| Total supply, . . . . . . | 70,441,052 | 75,341,898 |
| Exports for twelve months, deduct, . . | 18,052 | 5,146,297 |
| Net supply, . . . . . . | 70,423,000 | 70,195,601 |
| Stocks in storage December 29, deduct, . | 6,854,760 | 6,851,825 |
| Consumption for twelve months, . | 63,568,240 | 63,343,776 |
| Increase in consumption for 1907, . . | 224,464 | |

## MILK.

The summer price of milk for the Boston market was raised to 28½ cents per can (where the cans were returned clean by the contractors) in the 9-cent or so-called average zone. This was an increase of 2½ cents per can over the price paid in 1906, when it was 26 cents, making the 1907 summer price per quart to producers at railroad station 3.35+ cents. The winter price was raised to 35½ cents per can (clean cans), which was 6 cents more than was paid in the winter of 1906–07, and 7 cents increase over the summer price of 28½ cents, making the 1907–08 winter price per quart to the producer at railroad station 4.17+ cents. One-half cent more per can is paid where farmers wash their own cans.

The difference between the net Boston price of milk and the price paid the producer at the railroad station depends upon the distance from Boston, and the discounts from the Boston price are as follows: —

| | Cents. |
|---|---|
| For stations between 17 and 23 miles, | 6 |
| For stations between 23 and 36 miles, | 7 |
| For stations between 36 and 56 miles, | 8 |
| For stations between 56 and 76 miles, | 9 |

This last is called the middle or average zone, although it is undoubtedly inside the average. The zones beyond 76 miles are 20 miles wide, and 1 cent per can additional is deducted in each of these zones as the distance increases. The payment for milk on part of a majority of the larger contractors is governed by the so-called Knapp tables. The object of this system is to secure even production, and still allow a producer to increase or decrease his business by asking at the beginning of the six months for the rating he desires. We have thought best to publish a sample sheet of these tables, that the public may have a better knowledge of the system.[1] One of the contractors pays on a different basis, paying 2 cents per can less for unrestricted production. Another one of the smaller contractors buys milk paying a standard price for that between 3.6 and 4 per cent butter fat; for milk testing above 4 per cent and not above 4.2 per cent, 1 cent extra per can is paid; for milk testing above 4.2 per cent and not above 4.4 per cent, 2 cents, and above 4.4 per cent, 3 cents. If milk falls below 3.6, the price is decreased relatively; and if below 3 per cent, is not accepted. Another of the smaller firms buys a part of its supply on the butter-fat basis, paying a premium for all over 4 per cent fat.

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[1] See pages 280, 281.

The milk in southwestern Massachusetts is shipped to the New York market. The system of payment on part of the Willow Brook Dairy at Sheffield, for example, is the New York exchange price; at present writing, December, 4 cents per quart, subject to change at any time, but is based upon 4.2 per cent butter fat, 2½ cents being added to or subtracted from the price of a 40-quart can for each one-tenth above or below. In West Stockbridge the F. D. Shove Milk Factory pays by the hundred weight. This winter's price is as follows: October, $1.80; November, December, January and February, $2; and March, $1.80 per hundred weight.

The retail price in many of the cities and towns in the Commonwealth has been increased approximately 1 cent per quart over that of the winter of 1906. In some cases the consumption fell off temporarily, but it is believed that it is now rising towards normal. The producers supplying milk to such cities and towns have in the main received an advance in price, the price to the producer as a rule having been advanced about ½ cent per quart over that of last winter. This has given the producers near Boston about 5 cents at the farm on the average, those more remote 4½ cents, while in the western part of the State about 4 cents per quart is the prevailing winter price.

Forty-four samples of milk were taken at Barre Plains in November from the firm of C. Brigham Company, just as it was received from the farmers. For results of analyses and refractometer tests, see page 282.

One interesting case of adulterated milk was procured in another locality. A sample was taken from a peddler, and found to be wrong. Upon being notified of the result this peddler came at once to the office and declared that the milk was as he bought it, and asked as a favor that the dairies from which he was obtaining his supply be sampled. We did so, and on November 27 took a sample of the milk from one dairy, which analyzed 3.2 per cent fat; other solids, 8.24; total, 11.44; refractometer test, 39°. This farm had been delivering to the peddler for a month or more exactly 16 cans per day. On November 29 we saw this herd milked, took samples of known purity from the milk of each cow, and also of the mixed milk of the herd, with the result that the latter analyzed 4 per cent fat; other solids, 9.48; total solids, 13.48; refractometer test, 42.50.° The daily amount furnished the peddler from this dairy promptly fell off. The owner was tried later in the district court, found guilty and fined $50, from which he appealed.[1] For full results of analyses in this case see pages 282, 283.

For amount of milk received in Boston by railroad see page 283.

*Knapp Table, with Ratings, showing the Discounts for Overproduction and Underproduction in the 9-Cent Zone.*

| Table for Underproduction. | | | | 1907 and 1908. | Minimum and Maximum for the Month. | Table for Overproduction. | | |
|---|---|---|---|---|---|---|---|---|
| 32 cts.<br>34 cts.<br>33 cts.<br>31 cts. | 33 cts.<br>35 cts.<br>34 cts.<br>32 cts. | 34 cts.<br>36 cts.<br>35 cts.<br>33 cts. | 35 cts.<br>37 cts.<br>36 cts.<br>34 cts. | Oct.<br>Dec.<br>Jan.<br>Mar. | 35 cts.<br>37 cts.<br>36 cts.<br>34 cts. | 34 cts.<br>36 cts.<br>35 cts.<br>33 cts. | 33 cts.<br>35 cts.<br>34 cts.<br>32 cts. | 32 cts.<br>34 cts.<br>33 cts.<br>31 cts. |
| | | | | RATING. | | | | |
| 42- 50 | 51- 59 | 60- 66 | 67- 77 | 2½ | 78- 89 | 90- 96 | 97-105 | 106-114 |
| 50- 60 | 61- 70 | 71- 79 | 80- 92 | 3 | 93-106 | 107-115 | 116-125 | 126-136 |
| 58- 71 | 72- 83 | 84- 92 | 93-108 | 3½ | 109-125 | 126-134 | 135-146 | 147-160 |
| 66- 81 | 82- 94 | 95-105 | 106-123 | 4 | 124-142 | 143-153 | 154-166 | 167-182 |
| 75- 91 | 92-106 | 107-119 | 120-139 | 4½ | 140-160 | 161-173 | 174-188 | 189-205 |
| 83-101 | 102-118 | 119-131 | 132-154 | 5 | 155-178 | 179-191 | 192-208 | 209-227 |
| 99-122 | 123-141 | 142-158 | 159-185 | 6 | 186-213 | 214-230 | 231-249 | 250-273 |
| 116-142 | 143-165 | 166-184 | 185-216 | 7 | 217-249 | 250-268 | 269-291 | 292-318 |
| 133-163 | 164-189 | 190-211 | 212-247 | 8 | 248-284 | 285-306 | 307-332 | 333-363 |
| 149-183 | 184-212 | 213-237 | 238-278 | 9 | 279-320 | 321-345 | 346-374 | 375-409 |
| 166-203 | 204-236 | 237-264 | 265-309 | 10 | 310-355 | 356-383 | 384-416 | 417-454 |
| 182-224 | 225-260 | 261-290 | 291-340 | 11 | 341-391 | 392-421 | 422-457 | 458-500 |
| 199-244 | 245-283 | 284-317 | 318-371 | 12 | 372-426 | 427-460 | 461-499 | 500-545 |
| 216-265 | 266-307 | 308-343 | 344-402 | 13 | 403-462 | 463-498 | 499-540 | 541-590 |
| 232-285 | 286-331 | 332-370 | 371-433 | 14 | 434-497 | 498-536 | 537-582 | 583-636 |
| 249-306 | 307-355 | 356-396 | 397-464 | 15 | 465-533 | 534-574 | 575-623 | 624-681 |
| 265-325 | 326-378 | 379-423 | 424-495 | 16 | 496-568 | 569-613 | 614-666 | 667-727 |
| 282-346 | 347-402 | 403-449 | 450-526 | 17 | 527-604 | 605-651 | 652-707 | 708-772 |
| 298-366 | 367-426 | 427-476 | 477-557 | 18 | 558-639 | 640-689 | 690-749 | 750-818 |
| 315-387 | 388-448 | 449-502 | 503-588 | 19 | 589-675 | 676-729 | 730-790 | 791-863 |
| 332-408 | 409-473 | 474-529 | 530-619 | 20 | 620-710 | 711-766 | 767-831 | 832-908 |

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[1] In the Superior Court the plea of *nolo contendere* was entered and the $50 fine paid.

*Knapp Table, with Ratings, etc.* — Concluded.

| TABLE FOR UNDERPRODUCTION. | | | | 1907. | Minimum and Maximum for the Month. | TABLE FOR OVERPRODUCTION. | | |
|---|---|---|---|---|---|---|---|---|
| 34 cts. | 35 cts. | 36 cts. | 37 cts. | Nov. | 37 cts. | 36 cts. | 35 cts. | 34 cts. |
| | | | | RATING. | | | | |
| 40- 48 | 49- 56 | 57- 64 | 65- 74 | 2½ | 75- 85 | 86- 93 | 94-101 | 102-110 |
| 49- 59 | 60- 68 | 69- 76 | 77- 89 | 3 | 90-103 | 104-111 | 112-120 | 121-131 |
| 57- 68 | 69- 79 | 80- 89 | 90-104 | 3½ | 105-120 | 121-130 | 131-141 | 142-153 |
| 64- 78 | 79- 91 | 92-102 | 103-119 | 4 | 120-137 | 138-148 | 149-161 | 162-176 |
| 72- 88 | 89-103 | 104-115 | 116-134 | 4½ | 135-154 | 155-166 | 167-181 | 182-198 |
| 81- 98 | 99-114 | 115-127 | 128-149 | 5 | 150-172 | 173-185 | 186-201 | 202-219 |
| 96-118 | 119-137 | 138-153 | 154-179 | 6 | 180-206 | 207-222 | 223-241 | 242-264 |
| 112-138 | 139-160 | 161-178 | 179-209 | 7 | 210-241 | 242-259 | 260-281 | 282-308 |
| 128-157 | 158-183 | 184-204 | 205-239 | 8 | 240-275 | 276-296 | 297-322 | 323-352 |
| 144-177 | 178-205 | 206-230 | 231-269 | 9 | 270-309 | 310-334 | 335-362 | 363-396 |
| 160-197 | 198-228 | 229-255 | 256-299 | 10 | 300-344 | 345-371 | 372-402 | 403-440 |
| 177-217 | 218-251 | 252-281 | 282-329 | 11 | 330-378 | 379-408 | 409-442 | 443-483 |
| 193-236 | 237-274 | 275-307 | 308-359 | 12 | 360-412 | 413-445 | 446-483 | 484-527 |
| 209-256 | 257-297 | 298-332 | 333-389 | 13 | 390-447 | 448-482 | 483-523 | 524-571 |
| 225-276 | 277-320 | 321-358 | 359-419 | 14 | 420-481 | 482-519 | 520-563 | 564-615 |
| 241-296 | 297-343 | 344-384 | 385-449 | 15 | 450-515 | 516-556 | 557-603 | 604-659 |
| 257-316 | 317-366 | 367-409 | 410-479 | 16 | 480-550 | 551-593 | 594-643 | 644-703 |
| 273-335 | 336-389 | 390-435 | 436-509 | 17 | 510-584 | 585-630 | 631-684 | 685-747 |
| 289-355 | 356-412 | 413-460 | 461-539 | 18 | 540-619 | 620-667 | 668-724 | 725-791 |
| 305-375 | 376-435 | 436-486 | 487-569 | 19 | 570-653 | 654-704 | 705-764 | 765-835 |
| 321-395 | 396-458 | 459-512 | 513-599 | 20 | 600-687 | 688-741 | 742-804 | 805-879 |

| TABLE FOR UNDERPRODUCTION. | | | | 1908. | Minimum and Maximum for the Month. | TABLE FOR OVERPRODUCTION. | | |
|---|---|---|---|---|---|---|---|---|
| 31 cts. | 32 cts. | 33 cts. | 34 cts. | Feb. | 34 cts. | 33 cts. | 32 cts. | 31 cts. |
| | | | | RATING. | | | | |
| 39- 47 | 48- 55 | 56- 62 | 63- 72 | 2½ | 73- 84 | 85- 90 | 91- 98 | 99-107 |
| 46- 56 | 57- 66 | 67- 73 | 74- 86 | 3 | 87-100 | 101-107 | 108-117 | 118-128 |
| 54- 66 | 67- 77 | 78- 86 | 87-101 | 3½ | 102-117 | 118-126 | 127-237 | 138-150 |
| 61- 76 | 77- 88 | 89- 98 | 99-115 | 4 | 116-133 | 134-143 | 144-155 | 156-171 |
| 69- 85 | 86- 99 | 100-111 | 112-130 | 4½ | 131-150 | 151-162 | 163-176 | 177-193 |
| 77- 95 | 96-110 | 111-123 | 124-144 | 5 | 145-166 | 167-179 | 180-194 | 195-213 |
| 92-114 | 115-132 | 133-148 | 149-173 | 6 | 174-199 | 200-215 | 216-233 | 234-256 |
| 105-133 | 134-154 | 155-172 | 173-202 | 7 | 203-233 | 234-251 | 252-272 | 273-298 |
| 123-152 | 153-175 | 176-197 | 198-231 | 8 | 232-266 | 267-208 | 289-311 | 312-341 |
| 138-171 | 172-199 | 200-222 | 223-260 | 9 | 261-299 | 300-322 | 323-350 | 351-384 |
| 154-192 | 193-221 | 222-247 | 248-289 | 10 | 290-332 | 333-358 | 359-387 | 388-426 |
| 169-210 | 211-243 | 244-272 | 273-318 | 11 | 319-365 | 366-394 | 395-427 | 428-469 |
| 184-229 | 230-265 | 266-296 | 297-347 | 12 | 348-399 | 400-430 | 431-476 | 467-512 |
| 200-248 | 249-287 | 288-321 | 322-376 | 13 | 377-432 | 433-466 | 467-505 | 506-554 |
| 215-267 | 268-309 | 310-346 | 347-405 | 14 | 406-465 | 466-502 | 503-544 | 545-597 |
| 231-286 | 287-332 | 333-371 | 372-434 | 15 | 435-498 | 499-537 | 538-583 | 584-639 |
| 246-305 | 306-354 | 355-395 | 396-463 | 16 | 464-532 | 533-573 | 574-622 | 623-682 |
| 261-324 | 325-377 | 378-420 | 421-492 | 17 | 493-565 | 566-608 | 609-661 | 662-725 |
| 277-344 | 345-398 | 399-445 | 446-521 | 18 | 522-598 | 599-645 | 646-699 | 700-767 |
| 292-363 | 364-420 | 421-470 | 471-550 | 19 | 551-631 | 632-681 | 682-738 | 739-810 |
| 307-382 | 383-443 | 444-495 | 496-579 | 20 | 580-664 | 665-716 | 717-777 | 778-853 |

If a dairy outruns the limits of overproduction or underproduction printed in the Table, payment will be made at a price proportional to the production.

Please cancel all previous schedules.

*Samples of Milk for Boston Market, as delivered at Car by Farmers, taken from C. Brigham Company, at Barre Plains, Mass.*

| Sample Number. | Number of Cans. | Number of Cows. | Solids not Fat. | Fat. | Total Solids. | Ash. | Refractometer Reading (Degrees). |
|---|---|---|---|---|---|---|---|
| 1 | 5 | 9 | 8.90 | 4.80 | 13.70 | .60 | 41.3 |
| 2 | 6 | 10 | 9.20 | 4.50 | 13.70 | .60 | 41.3 |
| 3 | 12 | 18 | 8.90 | 3.90 | 12.80 | .56 | 40.8 |
| 4 | 20 | 18 | 8.72 | 4.10 | 12.82 | .54 | 40.5 |
| 5 | 10½ | 10 | 8.84 | 3.30 | 12.14 | .62 | 40.6 |
| 6 | 16 | 23 | 9.02 | 4.20 | 13.28 | .62 | 41.3 |
| 7 | 2 | 2 | 8.92 | 4.60 | 13.52 | .60 | 40.3 |
| 8 | 5 | 9 | 9.10 | 4.20 | 13.30 | .54 | 41.3 |
| 9 | 9 | 11 | 8.78 | 4.00 | 12.78 | .62 | 40.4 |
| 10 | 6 | 8 | 8.58 | 4.00 | 12.58 | .68 | 40.8 |
| 11 | 7 | – | 9.24 | 3.80 | 13.04 | .64 | 41.3 |
| 12 | 13 | 14 | 8.62 | 3.90 | 12.52 | .62 | 40.5 |
| 13 | 3 | 7 | 8.84 | 5.10 | 13.94 | .66 | 41.0 |
| 14 | 11 | 12 | 8.90 | 3.60 | 12.50 | .66 | 41.0 |
| 15 | 9 | 12 | 8.84 | 4.10 | 12.94 | .60 | 42.1 |
| 16 | 10 | 14 | 8.54 | 4.00 | 12.54 | .60 | 40.9 |
| 17 | 3 | – | 9.10 | 4.40 | 13.50 | .66 | 42.1 |
| 18 | 13 | 16 | 8.66 | 3.90 | 12.56 | .62 | 40.2 |
| 19 | 7 | 7 | 8.58 | 4.00 | 12.58 | .60 | 42.1 |
| 20 | 16 | 17 | 8.56 | 3.80 | 12.36 | .60 | 41.9 |
| 21 | 16 | 16 | 8.02 | 4.70 | 12.72 | .64 | 42.2 |
| 22 | 8 | 12 | 9.32 | 4.20 | 13.52 | .68 | 42.9 |
| 23 | 5 | – | 9.14 | 4.30 | 13.44 | .68 | 41.9 |
| 24 | 13 | 25 | 8.88 | 4.20 | 13.08 | .60 | 41.1 |
| 25 | 5 | – | 9.36 | 4.60 | 13.96 | .64 | 42.1 |
| 26 | 5 | 5 | 8.66 | 3.90 | 12.56 | .60 | 42.2 |
| 27[1] | 2 | 3 | 9.80 | 3.20 | 13.00 | .62 | 41.2 |
| 28 | 6 | – | 9.16 | 3.80 | 12.96 | .66 | 41.6 |
| 29 | 5 | – | 9.04 | 4.20 | 13.24 | .64 | 41.8 |
| 30 | 6 | – | 9.08 | 3.90 | 12.98 | .62 | 41.6 |
| 31 | 3 | – | 9.28 | 4.50 | 13.78 | .62 | 42.3 |
| 32 | 3 | 5 | 9.16 | 4.80 | 13.96 | .66 | 41.8 |
| 33 | 6 | 6 | 8.84 | 4.40 | 13.24 | .60 | 41.1 |
| 34 | 12 | – | 8.92 | 4.40 | 13.32 | .60 | 41.3 |
| 35[2] | 4 | 10 | 7.28 | 3.70 | 10.98 | .48 | 36.1 |
| 36 | 7 | 10 | 8.82 | 4.40 | 13.22 | .60 | 41.9 |
| 37 | 9 | 11 | 8.90 | 4.20 | 13.10 | .60 | 42.0 |
| 38 | 7 | 15 | 8.58 | 4.20 | 12.78 | .62 | 41.3 |
| 39 | 8 | 9 | 8.90 | 4.10 | 13.00 | .60 | 42.2 |
| 40[3] | – | – | – | – | – | – | – |
| 41 | 5 | 8 | 8.56 | 3.60 | 12.16 | .62 | 41.2 |
| 42 | 6 | 11 | 9.12 | 4.70 | 13.82 | .64 | 42.7 |
| 43 | 12 | – | 8.94 | 4.40 | 13.34 | .64 | 42.2 |
| 44 | 8 | 10 | 8.90 | 4.90 | 13.80 | .64 | 41.9 |
| Average of 41 normal samples, | | | 8.89 | 4.21 | 13.10 | .62 | 41.50 |

[1] Sample No. 27 showed partial skimming.

[2] Sample No. 35 showed added water.

[3] Sample No. 40 was lost.

*Samples taken from the Mixture of Night's Milk as brought from a Farm and delivered to a Peddler.*

| DATE. | Fat. | Other Solids. | Total. | Water. | Ash. | Refractometer Reading (Degrees). |
|---|---|---|---|---|---|---|
| Nov. 25, 1907, . . . . . | 3.3 | 7.80 | 11.10 | 88.50 | .60 | 39.00 |
| Nov. 27, 1907,[1] . . . . . | 3.2 | 8.24 | 11.44 | 88.56 | .60 | 39.00 |
| Nov. 29, 1907,[2] . . . . . | 4.0 | 9.48 | 13.48 | 86.52 | .72 | 42.50 |

[1] Witnessed.

[2] Milk of known purity.

*Milk of Known Purity from Individual Cows of Same Herd as Above, Nov. 29, 1907.*

| Cow. | Quarts. | Fat. | Other Solids. | Total. | Water. | Ash. | Refractometer Reading (Degrees). |
|---|---|---|---|---|---|---|---|
| No. 1, Holstein and Jersey, | 4 | 4.6 | 10.10 | 14.70 | 85.30 | .68 | 45.00 |
| No. 2, Grade Jersey, . . | 5 | 5.7 | 9.62 | 15.32 | 84.68 | .80 | 43.50 |
| No. 3, Grade Devon, . . | 3 | 5.0 | 10.00 | 15.00 | 85.00 | .84 | 43.00 |
| No. 4, Grade Ayrshire, . | 6 | 4.0 | 10.06 | 14.06 | 85.94 | .74 | 44.20 |
| No. 5, Grade Holstein, . | 7 | 3.4 | 8.94 | 12.34 | 87.66 | .64 | 42.00 |
| No. 6, Jersey and Durham, | 7 | 4.4 | 9.04 | 13.44 | 86.56 | .70 | 42.00 |
| No. 7, Grade Holstein, . | 6 | 3.3 | 8.80 | 12.10 | 87.90 | .60 | 41.50 |
| No. 8, Grade Jersey, . . | 6 | 4.6 | 9.74 | 14.34 | 85.66 | .78 | 42.00 |
| No. 9, Grade Holstein, . | 6 | 3.7 | 8.50 | 12.20 | 87.80 | .64 | 41.00 |
| No. 10, Jersey and Devon, . | 5 | 4.7 | 10.26 | 14.96 | 85.04 | .66 | 42.30 |
| No. 11, Grade Holstein, . | 9 | 3.3 | 9.38 | 12.68 | 87.32 | .70 | 42.00 |
| Average, . . . | – | 4.24+ | 9.49+ | 13.74 | 85.35+ | .70+ | 42.59+ |

The following are the figures concerning carred milk, as reported by the various railroads to the Railroad Commissioners: —

*Milk brought into Boston by the Different Railroads, December, 1906, to December, 1907, as reported to the Railroad Commissioners.*

| Date. | Boston & Albany (Quarts). | Boston & Maine (Quarts). | New York, New Haven & Hartford (Quarts). | Total Quarts. |
|---|---|---|---|---|
| **1906.** | | | | |
| December, . | 1,382,567 | 6,054,571 | 1,638,630 | 9,075,768 |
| **1907.** | | | | |
| January, . . | 1,386,749 | 6,211,815 | 1,586,577 | 9,185,141 |
| February, . | 1,239,827 | 5,523,853 | 1,516,558 | 8,280,238 |
| March, . . | 1,445,484 | 6,248,497 | 1,705,893 | 9,399,874 |
| April, . . | 1,472,430 | 6,185,519 | 1,828,261 | 9,486,210 |
| May, . . | 1,638,766 | 6,425,503 | 2,008,164 | 10,072,433 |
| June, . . | 1,691,241 | 6,487,446 | 2,080,381 | 10,259,068 |
| July, . . | 1,648,596 | 6,669,955 | 1,933,398 | 10,251,949 |
| August, . . | 1,452,650 | 5,970,386 | 1,807,663 | 9,230,699 |
| September, . | 1,170,560 | 5,574,826 | 1,708,373 | 8,453,759 |
| October, . . | 1,333,905 | 5,037,707 | 1,821,845 | 8,193,457 |
| November, . | 1,117,282 | 5,087,587 | 1,788,725 | 7,993,594½ |
| Totals, . | 16,980,057 | 71,477,665 | 21,424,468 | 109,882,190½[1] |

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[1] The total for the corresponding twelve months, 1906-07, was 114,233,976 quarts.

## Creameries and Milk Depots.

Appended we give a revised list of the principal creameries and milk depots owned and operated by Massachusetts individuals and corporations. There are in this State, in addition to these, a number of distributing plants for creameries owned and operated in other States. For instance, the Maine Creamery Company of Bangor, Me., has offices at 12 Foster Wharf, Boston. The Turner Centre Creamery of Auburn, Me., has distributing houses in Boston, Worcester, Taunton and Lowell, and ships to these points butter, cream, and to one at least skimmed milk.[1] The New England Creamery of Livermore Falls, Me., distributes through a Massachusetts company of the same name in Everett, which also distributes the "Hampden Creamery" goods. The Lyndonville Creamery of Lyndonville, Vt., has a plant at Watertown, from which it distributes milk, cream and butter. J. L. Humphrey, Jr., has four plants, one each in New Bedford, Fall River, Taunton and Brockton, for the distribution of butter and renovated butter from his Iowa creameries. The Armours, Swifts, Hammonds, Morrises and other large packing houses, all representing western-made goods, distribute quantities of butter and renovated butter from their numerous establishments scattered over the State. Some of these also put out oleomargarine. Besides these, there is a considerable number of creamery companies and so-called creameries which buy their stock of producers in this and other States. These in the aggregate do a large business. Other private dairies or creameries also have town offices, restaurants, etc. The above is difficult of strict classification.

A number of dairies are producing milk and cream under conditions and of a quality which command a price higher than that ruling the general market, and at least two are selling certified milk.

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[1] Pasteurized skimmed milk and cream are put together in the proper proportions required for standard milk, in the Boston plant, and the milk thus made is placed upon the market.

*Creameries and Milk Depots in Massachusetts.*

| Location. | Name. | Co-operative or Proprietary. | Superintendent or Manager. |
|---|---|---|---|
| Amherst, | Amherst Creamery, | Proprietary, | F. J. Humphrey, agent. |
| Amherst, | Fort River, | Proprietary, | E. A. King. |
| Amherst, | Dairy Farming Course, Massachusetts Agricultural College. | Educational, | Prof. W. P. Brooks, director. |
| Ashfield, | Ashfield Creamery, | Co-operative, | William Hunter. |
| Belchertown, | Belchertown Creamery, | Co-operative, | M. G. Ward, president. |
| Boston, 494 Rutherford Avenue, | H. P. Hood & Sons,[1] | Proprietary, | H. P. Hood & Sons. |
| Boston, office 1171 Tremont Street, | Alden Bros.,[2] | Proprietary, | Charles L. Alden. |
| Boston, Wales Place, | Elm Farm Milk Company, | Proprietary, | James H. Knapp, manager. |
| Boston, 556 Rutherford Avenue, | D. Whiting & Sons, | Proprietary, | D. Whiting & Sons. |
| Boston, 388 Rutherford Avenue, | Boston Dairy Company, | Proprietary, | Boston Dairy Company. |

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[1] H. P. Hood & Sons have branches at 193 Alley Street, Lynn; 252 Bridge Street, Salem; 105 Holmes Street, Dorchester; 425 Main Street, Malden.

[2] Alden Bros.' Creamery is at 28 Duncan Street.

*Creameries and Milk Depots in Massachusetts* — Continued.

| LOCATION. | Name. | Co-operative or Proprietary. | Superintendent or Manager. |
|---|---|---|---|
| Boylston, | Adelphia Creamery, | Proprietary, | E. M. Laws. |
| Bridgewater, | Plymouth County Creamery,[1] | Proprietary, | S. Neilson Houlburg. |
| Brimfield, | – – | Proprietary, | F. N. Lawrence. |
| Cambridge, 158 Massachusetts Avenue. | C. Brigham Company, | Proprietary, | C. Brigham Company. |
| Cheshire (P. O., Adams), | Greylock Creamery, | Co-operative, | C. J. Fales, president. |
| Cummington, | Cummington Creamery, | Co-operative, | M. S. Howes, president. |
| Easthampton, | Hampton, | Co-operative, | W. H. Wright, treasurer. |
| Egremont (P. O., North Egremont), | Egremont Creamery, | Co-operative, | H. O. Harrington. |
| Everett, | Hampden Creamery Company, | Proprietary, | Hampden Creamery Company. |
| Framingham (P. O., South Framingham). | Echo Farm Company,[1] | Proprietary, | J. A. Turner. |
| Fitchburg, 26 Cushing Street, | Fitchburg Creamery, | Proprietary, | G. S. Learned. |
| Gardner, | Boston Dairy Company, | Proprietary, | Boston Dairy Company. |
| Groton, | Lawrence Creamery, | Proprietary, | Myron P. Swallow. |

| | | | |
|---|---|---|---|
| Heath, | Cold Spring Creamery, | Proprietary, | I. W. Stetson & Son. |
| Hinsdale, | Hinsdale Creamery, | Proprietary, | Hinsdale Creamery Company. |
| Lee, | Lenox Creamery, | Co-operative, | P. A. Agnew, manager. |
| Leominster, | Leominster Creamery, | Proprietary, | G. H. Wass, manager. |
| Marlborough, | Este's Creamery, | Proprietary, | F. F. Este. |
| Montague, | Montague Creamery, | –[2] | W. A. Pease, manager. |
| Monterey, | Berkshire Hills Creamery, | Co-operative, | Henry Clapp, treasurer. |
| New Boston, | Berkshire Creamery, | Co-operative, | N. H. Snow, president. |
| New Salem (P. O., Millington), | New Salem Co-operative Creamery Company. | Co-operative, | W. A. Moore. |
| North Brookfield, | North Brookfield Creamery, | Proprietary, | H. A. Richardson. |
| Northfield, | Northfield Creamery, | Co-operative, | L. R. Smith. |
| Orange (P. O., North Orange), | North Orange Creamery, | Co-operative, | C. E. Dunbar. |
| Sheffield, | Willow Brook Dairy,[3] | Proprietary, | George Patterson. |
| Shelburne, | Shelburne, | Co-operative, | Ira Barnard. |

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[1] Cream only.

[2] Leased and operated by Tait Bros., Springfield.

[3] Receiving station, milk shipped to New York.

*Creameries and Milk Depots in Massachusetts* — Concluded.

| LOCATION. | Name. | Co-operative or Proprietary. | Superintendent or Manager. |
|---|---|---|---|
| Shelburne Falls, | Totman's Creamery, | Proprietary, | T. M. Totman. |
| Southborough, | Deerfoot Farm, | Proprietary, | S. H. Howes, manager. |
| Springfield, | Springfield Milk Association, | Co-operative, | F. B. Allen. |
| Springfield, | Tait Bros., | Proprietary, | Tait Bros. |
| Uxbridge, | Farnum Creamery, | Proprietary, | Geo. A. Farnum. |
| Westfield (P. O., Wyben), | Wyben Springs Creamery, | Co-operative, | C. H. Wolcott. |
| West Newbury, | West Newbury Creamery, | Co-operative, | R. S. Brown, treasurer. |
| West Stockbridge, | F. D. Shove Milk Factory,[1] | Proprietary, | C. E. Hardy, superintendent. |
| Williamsburg, | Williamsburg Creamery, | Co-operative, | E. T. Barrus, president. |
| Worthington (P. O., Ringville), | Worthington Creamery, | Co-operative, | M. R. Bates, superintendent. |
| Worcester, | Wachusett Creamery, | Proprietary, | E. H. Thayer & Co. |

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[1] Milk for New York market.

## EXPENSES.

The following is a classified statement of the expenses for the year ending Nov. 30, 1907 : —

| | |
|---|---|
| Bureau: compensation and travelling expenses, | $339 31 |
| Agents: compensation, | 1,936 50 |
| Agents: travelling expenses and samples purchased, | 2,527 84 |
| General agent: travelling and necessary expenses, | 493 46 |
| Chemists: analyses, tests, court attendance, | 1,120 50 |
| Printing and supplies, | 105 92 |
| Educational, | 476 47 |
| Total, | $7,000 00 |

P. M. HARWOOD,
*General Agent.*

Accepted and adopted as the report of the Dairy Bureau.

CARLTON D. RICHARDSON.
JOHN M. DANFORTH.
HENRY E. PAIGE.

# FOURTH ANNUAL REPORT

OF THE

# STATE FORESTER.

# REPORT OF THE STATE FORESTER.[1]

*To the General Court.*

It is with a degree of pleasure that I offer this my first annual report, although the fourth since the establishment of the office of State Forester.

The efficiency of the office during the past year has been greatly increased in every direction. All of the lines of work previously begun by my predecessor have been carried forward, and many new features added. The work of making examinations and giving advice on forestry matters has been constantly growing, until at present the head of the department finds it almost impossible to meet the demands with his present force of assistants. The correspondence alone, we are told by the post-office authorities, has increased fully two hundred per cent during the year.

The hearty co-operation asked for upon my accepting the position of State Forester has been more than realized in the very hearty and cordial assistance rendered on every hand.

After a careful study of our forestry conditions, and definitely deciding upon what legislation was needed most, we were fortunate in being able to present some bills before the last General Court, even after the usual time had expired, due to the recommendations in Governor Guild's inaugural. These bills met with approval and were enacted.

At the forestry hearing before the committee on agriculture practically every organization in the State interested in forestry was present. It would be impossible to have had a more representative hearing.

The following organizations passed definite resolutions favoring the bills which afterwards were enacted: the Massachusetts

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[1] House Document No. 1225, 1908.

State Grange, at their annual meeting at Faneuil Hall, in Boston; the Massachusetts State Board of Agriculture, at their annual winter meeting; the Eastern Shook and Wooden Box Manufacturers Association, at their annual meeting at Young's Hotel, Boston. The executive committee of the Massachusetts Forestry Association assisted in many ways, and to Mr. Henry James, Jr., the chairman, I desire to give the credit of shaping these bills in their present excellent form. The presidents of the railroads traversing our State also gave their personal support toward better forest fire regulations and laws.

## Forest Laws Publication.

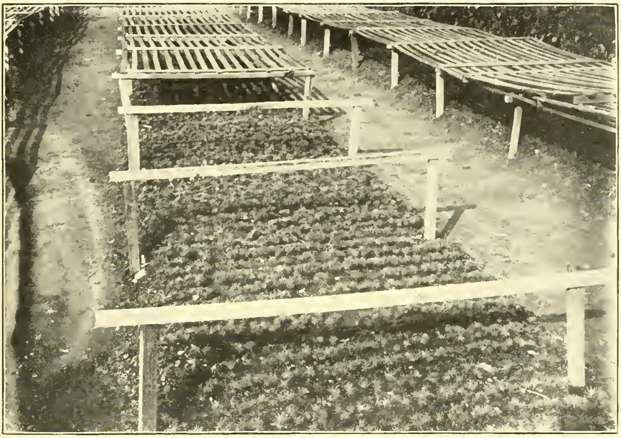
Upon the passage of the new forest laws the State Forester compiled the various enactments of the State forest laws, and had the same printed in a small booklet, 10,000 copies of which have been distributed quite generally throughout the State. This booklet is of convenient size for carrying in one's pocket, and also can be sent in an ordinary letter envelope, and hence is admirably adapted for dissemination and use. The double index system of reference is carried out in the publication, the paragraphs being indicated by heavier type side headings.

## Forest Fire Posters.

Following the instructions in the statutes, the State Forester had the abbreviated instruction of the forest fire laws printed on a large poster, 18 by 27 inches in size, and distributed generally throughout the Commonwealth. Paper posters were printed for use indoors, while similar cloth posters were distributed for out-of-door use. The main heading, "Forest Fire Laws," was printed in large letters of bright red, while the remainder was printed in green ink. In compliance with the law, the railroads have placed a poster in each of their depots, and similar notices are to be found in the various post-offices of the State. The others have been posted by the town authorities.

## The Forest Warden Law.

Beginning with the coming spring elections in the towns, in accordance with the legislation of 1907, the new board of selectmen is empowered to appoint a forest warden, who



THE STATE NURSERY AT AMHERST.

White pine seedlings at the end of the first season.

shall be given authority to look after the forest interests of the town.

The particular channel of usefulness whereby the recent enactments of the Legislature have made it possible for the State Forester to accomplish results is through this town forest warden system.

The appointment of the town forest warden is subject to the approval of the State Forester. His compensation is met by the individual towns, and he has the power of appointing his deputies.

The forest warden may also be called upon by the State Forester for whatever information is desired from time to time: as the correcting of his town forest acreage; amount of reforestation done during the year; number and kinds of forest fires; depredations from insect and fungous disease outbreaks, etc. For this work the warden is compensated by the State Treasurer through bills presented to and approved by the State Forester. For this work he is paid at the rate of not to exceed 35 cents an hour.

The State Forester has the privilege of calling and making arrangements for conventions of forest wardens, and paying wholly or in part their travelling expenses, the only provision being that no money shall be expended in paying the travelling expenses of any one warden to or from more than one convention in any one year; that the total expense of said convention shall not exceed $2,000, and be held within the Commonwealth. This enactment ought to furnish to a certain extent the brief schooling each year in practical forestry to the men who most need it for accomplishing economic results in the State. The law also, it will be seen, allows the State Forester the privilege of retaining valuable wardens in the various towns when they have proven their merit.

Through this law we now have a thoroughly systematized plan of usefulness, a natural channel through which it is believed much good to our forest interests must result. When we once get a thoroughly organized corps of competent forest wardens, one in each of our three hundred and twenty towns, who can intelligently handle forest fires and other forestry matters of vital concern, we shall have made great progress, both from the economic and æsthetic standpoints. The small booklet, "Brief

Instructions to Massachusetts Forest Wardens," discusses quite fully the duties of the forest warden. This is obtainable at the State Forester's office.

### SPARK ARRESTERS ON RAILROAD ENGINES.

In compliance with the law passed at the last session of the Legislature, the Railroad Commission had a conference with the various railroads of the State, and after going over the matter of establishing what was thought to be an efficient spark arrester for every engine on each road operating in the State, the commission sent out the following orders to the railroad authorities. (The following being an example of that sent to one road): —

*Petition of the New York Central and Hudson River Railroad Company, Lessee of the Boston & Albany Railroad, for Approval of Installation and Maintenance of a Spark Arrester.*

After consideration, it is —

*Ordered,* That the approval of the Board, under the provisions of chapter 431 of the Acts of 1907, be hereby given to the installation and maintenance on engines of the Boston & Albany railroad of spark arresters of the type submitted with the petition, and shown upon plan filed therewith, entitled "New York central lines; smoke box; interior arrangement; locomotive," and dated Oct. 16, 1906.

Attest: (Signed) CHARLES E. MANN,
*Clerk.*

The only thing yet to be established is that some definite methods of efficient inspection be arranged, and it is believed this is a matter that the railroads will regulate satisfactorily.

### PUBLIC LECTURES AND ADDRESSES.

The calls for lectures on forestry by the State Forester have been many. It has been made a policy to accept invitations to address public meetings whenever it can be shown that good results are likely to follow. In accepting invitations, the request is made that an audience of at least one hundred be guaranteed, if possible. This request has invariably resulted in more activity on the part of the local organizations in getting out large numbers, and in more efficient and far-reaching service on the part of the State Forester. An example of this might be cited. In asking for an address on forestry by an organization whose membership was thirty-six, the acceptance was on the condition that the meeting be made public, and under the usual requirements, resulting in an audience of over five hundred. The number of lectures delivered during the year was forty-five.

### Lectures at the Agricultural College.

In accordance with arrangements made with the authorities representing the trustees of the college, a course of instructions on forestry, consisting of ten lectures and exercises, was given by the State Forester to the students of the college last spring. I am frank to say that it would be impossible to work with a more satisfactory and intelligent body of students than attended this course of lectures.

A talk on forestry was also given by the State Forester before the Conference on Rural Progress, called by President Kenyon L. Butterfield in October at the Agricultural College.

### The National Irrigation and Forestry Congress.

The State Forester was invited to address the above congress at Sacramento, Cal., September 2 to 7, on "State Forestry Development," and present a paper upon "The Use of Artificial Fertilizers in Forestry." This trip was also made use of in visiting some large commercial nurseries in the middle west, as well as studying general forestry methods on the Pacific coast. The congress proved a great success, and was teeming with enthusiasm and interest, peculiar to western hustle. Similar meetings in the east would be productive of great good. Massachusetts was the only New England State that was represented by a delegate, and even New York and Pennsylvania were not represented. There are many features about our New England environment and conditions that are of great advantage in forestry. One thing particularly, — we do not have the dry season to overcome; and in reforestation this one thing is greatly in our favor, to say nothing about better markets, etc. An easterner does well to study the comparative conditions of the east and west. If we were to keep much of our capital at home, and employ it equally as lavishly toward modern forestry or even agriculture, I believe as good or even better results could be assured.

## OTHER LECTURES OUTSIDE THE STATE.

The State Forester has been called upon to address various other organizations of a national or State nature outside this State, and was able to give addresses on forestry before the following: the Society for the Promotion of Agricultural Science, held at Lansing, Mich., May 29; the National Horticultural Congress, held at Jamestown Exposition, September 23; and the New Hampshire State Board of Agriculture's annual winter meeting, at Whitfield, December 5. The meeting of the American Association for the Advancement of Science, which convened in New York the first of the year, was also attended.

## PUBLICATIONS.

The publications of the office for the year are as follows: —

| | Pages. | Copies. |
|---|---|---|
| "The Commonwealth of Massachusetts Forest Laws," | 50 | 10,000 |
| "Brief Instructions to Massachusetts Forest Wardens," | 12 | 5,000 |
| "How and when to collect White Pine Seed," | 16 | 10,000 |
| "Forestry from the Commercial Standpoint," | 16 | 5,000 |
| "The Commercial Forest Trees in Massachusetts, how you may know them" (in press). | 68 | 5,000 |
| "Forestry in the Primary Schools" (in press), | 50 | 5,000 |
| "Forest Laws concerning Railroads," | 8 | 5,000 |
| Total, | 220 | 45,000 |

## THE FOREST NURSERY AT AMHERST.

Last spring the nursery work was reorganized and placed in the hands of R. S. Langdell of Lowell, a former student of the writer, who has greatly improved the nursery, although it has been carried on under very limited conditions. Instead of having the land allotted by the college in different places, as heretofore, it has been concentrated, and therefore more easily handled. A small, inexpensive tool and packing shed has been erected, where necessary implements for nursery work are housed and seedlings packed for shipment.

THE STATE NURSERY AT AMHERST.

Beds of white ash, ready for distribution.

### (a) *General Forest Seedlings distributed.*

In order to awaken interest and distribute seedlings throughout the State, notices were sent to all newspapers of the State, asking them to print the following offer from the State Forester: —

*Seedling Forest Trees Available.* — F. W. Rane, State Forester, State House, Boston, gives notice that he can distribute, to a limited number of those who apply, 150 white pine and 150 white ash, two-year-old trees, suitable for setting out for forest purposes. Send $1 with order. Express charges will be advanced. No orders received after April 30. One order only per person, as the object is to disseminate them quite generally. Should the supply become exhausted, the money will be returned.

Set the plants where they are to grow, 6 by 6 feet apart, as soon as they are received. Do not allow the roots to get dry.

It is hoped that this one-fourth-acre planting will create an interest in doing more planting later. It is understood that these seedlings are to be planted in Massachusetts.

In response to this offer, one hundred and twenty and one-half orders were sent out, as indicated in the following table: —

| Name. | Address. | Name. | Address. |
|---|---|---|---|
| Azro A. Coburn, | Holyoke. | Lewis Damon, | Ashby. |
| Arthur M. Robinson, | Pittsfield. | James L. Miller, | West Lynn. |
| W. W. Willard, | Springfield. | W. L. Harris, | Deerfield. |
| James H. Newton, | Holyoke. | Horace T. Fogg, | Norwell. |
| Robert M. Woods, | – – | John W. Waters, | Fitchburg. |
| Mrs. Wm. L. Paddock, | Dalton. | Arthur P. Rugg, | Sterling. |
| J. S. Hubbard, | Fiskdale. | P. W. McCellan,[1] | Haverhill. |
| W. L. White, | Phillipston. | Eben S. Fuller, | Clinton. |
| Pontoosuc Woolen Manufacturing Company, | Pittsfield. | J. W. Van Huyck, | Lee. |
| James Griffin, | South Hadley. | A. J. Wellington, | Ashburnham. |
| Charles W. Power, | Pittsfield. | E. F. Powers, | Leominster. |
| Geo. H. Goodbeer, | Fitchburg. | Lester R. Maynard, | South Berlin. |
| Wm. B. Kimball, | Enfield. | L. B. Ramsdell, | Gardner. |
| John H. Holder, | Hudson. | W. A. Munson, | Huntington. |
| H. G. Zilliacus, | Fitchburg | Claude J. Mathieu, | West Boylston. |
| Roy L. Eaton, | Salisbury. | Joseph Smith, | Unionville. |
| Silas W. Hutchinson, | Fitchburg. | David H. Tillson, | Amherst. |
| Waldo C. York, | Marstons Mills. | Edward F. White,[1] | Holyoke. |
| Thomas C. Esty, | Amherst. | Charles L. Johnson, | Southborough. |
| C. H. Waymouth, | Fitchburg. | R. L. Bowman, | Middleborough. |
| Albert F. White, | East Freetown. | J. M. Perkins, | Hudson. |
| Miss Helen Holmes, | Kingston. | Henry F. Whitney, | Lowell. |
| Willis F. Austin, | Amesbury. | Myron A. Richardson, | West Brookfield. |
| W. F. Whitney, | South Ashburnham. | Edwin Warren, | Spencer. |
| Warren F. Bemis, | Hubbardston. | Thaxter Scott & Son, | Hawley. |
| Priest Bros., | Littleton. | Geo. E. Cogswell, | Cushman. |
| | | J. F. Rice, | Barre. |
| | | Walter F. Partridge, | West Upton. |
| | | J. Henry Gleason, | Marlborough. |

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[1] Two orders.

| NAME. | ADDRESS. | NAME. | ADDRESS. |
|---|---|---|---|
| Chas. M. Phelps, | Blandford. | Walter White, | Templeton. |
| Marcus M. Multer, | Marlborough. | C. R. Stewart, | Templeton. |
| Thos. H. Skinner, | Princeton. | Wm. B. Hale, | Templeton. |
| E. H. Alderman, | Chester. | Seth P. N. Hall, | Williamsville. |
| Mrs. Adolph Miller, | West Springfield. | A. B. Terry, | Williamsville. |
| Mrs. Mary A. Butterick, | Sterling. | A. S. Lodge, | Williamsville. |
| G. L. Twitchell, | Brookfield. | L. E. Parminter, | Williamsville. |
| C. L. Fairbanks, | Southborough. | L. W. Buffington, | Williamsville. |
| E. W. Howe, | Concord. | L. W. Morgan, | Williamsville. |
| Chas. F. Allen, | Rowley. | B. F. Collins, | Williamsville. |
| Frank Sprague, | Still River. | L. M. Thomas, | Templeton. |
| P. C. Bronson, | Ashfield. | Benjamin D. Hyde, | North Amherst. |
| F. H. Holden, | Plainfield. | W. A. Graves, | Greenfield. |
| D. S. Freeman, | Millington. | R. R. Ranney, | Ashfield. |
| John H. Daniels, | Fitchburg. | W. H. Carter, | Andover. |
| C. H. Ball, | East Windsor. | Miss Sarah Fuller, | Newton Lower Falls. |
| R. F. Walsh, | Easthampton. | | |
| Wm. Haskett, | South Athol. | Ella C. Jordan, | Newton Lower Falls. |
| F. W. Whitney, | South Athol. | | |
| O. E. Bradway, | Monson. | Geo. B. Haskell, | Rochester. |
| Julia F. Darling, | Milford. | Charles A. Stone,[1] | Plymouth. |
| Wm. Hale, | Newburyport. | Fred A. Hannaford, | South Lancaster. |
| H. J. Franklin, | Wareham. | L. Cora Brown, | Concord. |
| Henry M. Allen, | Chilmark. | Thomas R. B. Dole, | Ayer. |
| Lot Phillips & Co.,[1] | West Hanover. | A. M. Bridgman, | State House, Boston. |
| J. W. Howes, | South Fall. | | |
| E. C. Wright, | Campello. | Arthur H. Wellman, | Topsfield. |
| C. E. Norton, | Cambridge. | A. P. White, | Salem. |
| J. A. Monahan, | Fiskdale. | C. H. Copeland, | Scituate. |
| C. H. Johnson, | Easthampton. | Geo. W. Burroughs, | Acton. |
| Edwin A. Start, | Billerica. | L. L. Lewis, | Ashland. |
| F. H. Foster, | Andover. | F. W. Peters, | Bolton. |
| H. Gertrude Hale, | Templeton. | | |

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[1] Two orders.

### (b) *Distribution of Forest Tree Seeds and Seedlings to Schools.*

Thinking our public schools might be interested in having some seeds and seedlings for educational purposes, the following letter was addressed to each superintendent in the State: —

*To School Superintendents.*

In connection with the State forest service we have a forest nursery, and it has occurred to me that there are schools that would derive a great deal of knowledge and economic benefit from having a small collection of forest tree seedlings growing in the school grounds or in the school gardens where they are already established.

Forestry is a subject worthy of promotion, and the simple A B C of forestry can well be begun with our school children. Trees have much of interest in them at any time of the year, and hence can be studied at any season. There is wide interest at present in school gardening; if to it we add some forest nursery work, making it a year-round affair and a perennial rather than for a short season each year, I am sure it will be a happy improvement.

Make it a plan to have the children collect tree seeds when they are ripe; then plant and care for the seedlings, ultimately transplanting them upon our many thousand acres of waste land in all sections of our Commonwealth. Some seeds, like the acorn and chestnut, may be planted directly where they are to grow.

In order to assist any schools in a beginning, I am going to offer to a limited extent, in so far as our seedlings hold out, and we can spare the time to do the work, — first come, first served, — a collection of seedlings and seed as follows: —

12 white pine seedlings, two years old.
24 white ash seedlings, two years old.
12 red spruce seedlings, two years old.
5 beech seedlings.

½ ounce of white pine seed (900 seed).
12 chestnut seed.
25 acorn seed.
50 white ash seed.

Bulletin No. 4 of this office, giving instructions for handling and care of the nursery, will be sent with each order.

The only expense to the school requesting this list will be the estimated actual expense in digging, packing, etc., $1 for each collection. The express charges will be advanced. Only one collection is offered a school. The $1 should accompany the order. Should we be unable to send the collection, the money will be returned. No orders should be sent in to reach the office later than May 1.

It is hoped that in this small beginning we may foster in the young, our coming generation, not only a fundamental economic recognition of forestry, but return to Massachusetts and New England the natural beauty we all so much would love to see.

Yours very sincerely, F. W. RANE,
*State House, Boston, Mass.*

In response to this offer forty-seven orders were received, and sent out as indicated in the following table: —

| NAME. | ADDRESS. | NAME. | ADDRESS. |
|---|---|---|---|
| C. H. Morse, | Medford. | Frank A. Andrews, | Greendale school, Worcester. |
| Mary L. Lincoln, | Lancaster. | Mary L. Potter, | Lawrence. |
| H. E. Richardson, | Greenfield. | Florence Marshall, | Tolland. |
| Amelia R. Amos, | North Attleborough. | John I. Rackcliffe, | Campello. |
| A. L. Hardy, | Amherst (2 orders). | Edward Warren, | Spencer. |
| J. W. Waters, | Fitchburg. | Benj. D. May, | Nantucket. |
| Prof. C. M. Weed, | Lowell. | Jessie P. Leary, | Salem. |
| John G. Thompson, | Fitchburg. | Jennie C. Foskett, | Charlton. |
| W. S. Bagg, | Springfield. | Wm. H. Martin, | Comins school, Roxbury Crossing, Boston. |
| S. D. Brooks, | Brighton. | Lincoln Owen, | Rice school, Boston. |
| C. S. Lyman, | Hudson. | M. S. Donaldson, | Brockton. |
| Monatiquot school, | Braintree. | M. L. Brown, | Rhode Island Normal School, Providence, R. I. |
| Penniman school, | Braintree. | F. A. Morse, | R. G. Shaw school, Boston. |
| Noah Torrey school, | South Braintree. | Helen F. Batchelder, | Bridgewater. |
| W. L. Coggins, | Rockland (8 orders). | E. H. Russell, | State Normal School, Worcester. |
| W. E. Gushee, | Ludlow (3 orders). | Nellie L. Bailey, | School Street school, Haverhill. |
| E. F. P. Perrin, | Grammar school, West Barnstable. | | |
| L. M. Moody, | High school, Hyannis. | | |
| S. W. Ferguson, | Osterville. | | |
| Miss R. O. Kendall, | Pittsfield. | | |
| Miss Adah L. Harvey, | Northfield grammar school. | | |

Fifteen thousand two-year-old white pine seedlings were purchased from the New York State Forester and several thousand from other sources, which were used in filling the above orders.

Each person for whom a forest working plan or assistance in forestry has been given, in so far as there were records in the office, was consulted, that he might be assisted in procuring seedlings at reasonable rates. The office charged in each instance simply enough to cover the expense of first cost to the State. Where many small lots, as to schools and farmers, were sent, the expense of packing for shipment has been proportionally higher than were we shipping in larger quantities.

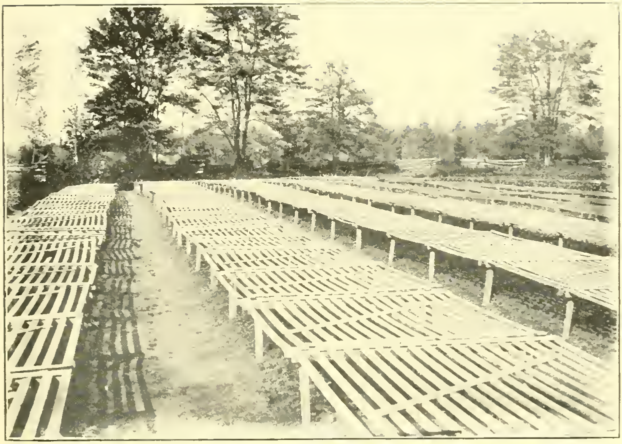
### (c) *Other Seedlings distributed.*

Besides the above, the following seedlings were also distributed from the nursery: —

| | |
|---|---|
| C. F. King, Taunton, 5,000 white ash, | $15 00 |
| Mr. Paine, State House, 250 beech, 500 white ash, | 2 25 |
| Mr. Paine, State House, 1 pound white pine seed, | 4 00 |
| F. A. Smith, Taunton, 1,000 white ash, | 3 00 |
| Theodore F. Borst, South Framingham, 6,000 white ash, | 18 00 |
| W. G. Nickerson, Dedham, 3,000 white ash, | 9 00 |
| Alfred S. Hayes, Ashland, 4,000 white ash, | 12 00 |
| Lyman E. Ware, Norfolk, 1,000 white ash and 50 white pine, | 3 25 |
| Edward Sturgis, Andover, 500 white pine, | 1 50 |
| C. N. Field, Foxborough, 100 white ash, | 35 |
| Total, | $68 35 |

*Nursery Stock on Hand, Fall, 1907.*

| | |
|---|---|
| White ash transplants, | 40,000 |
| White pine, one year old, | 200,000 |
| White pine, two years old, | 15,000 |
| Norway spruce, one year old, | 25,000 |
| Norway spruce, two years old, | 2,000 |
| Catalpa, one year old, | 3,500 |
| Chestnut, one year old, | 90 |
| Sycamore, | 200 |
| Maple, red, | 2,000 |
| Maple, rock, | 100 |
| White pine, two years old, purchased from nurserymen, | 250,000 |
| Total, | 538,790 |



PORTION OF THE STATE NURSERY AT AMHERST.

Showing the screen protection given evergreen seedlings.

*Seed collected, 1907.*

| | |
|---|---|
| White pine, | 65 pounds. |
| Chestnut, | 1 bushel. |
| Box elder, | 1 bushel. |
| Locust, | small amount. |
| Horse chestnut, | " " |
| Norway spruce, | " " |
| Pitch pine, | " " |
| Austrian pine, | " " |
| Tulip tree, | " " |
| Maple, | " " |

Fifty pounds of white pine-seed have also been purchased for spring distribution.

The trustees of the Agricultural College have voted additional land for next spring's use in enlarging the present area. It is believed we can well afford to do even more in growing and distributing various tree seedlings at cost. When the time comes that commercial growers are prepared to furnish them at lower rates, the States' policy will undoubtedly be to do less.

## Forestry Exhibits.

Two forestry exhibits have been made by the State Forester during the year, one at the Sportsmans' Show, held at the Mechanics building in Boston last spring, and the other at the annual winter meeting of the State Board of Agriculture, held at Horticultural Hall, Boston, December 3, 4 and 5. The exhibit consisted in showing different kinds of forest seeds and seedlings of various ages. The seedlings and transplants were displayed in the ordinary seed-bed conditions, and also suspended in glass jars, so the whole root system could be shown. Photographs, forest maps, wood sections, forest implements, charts, forest fire posters and a full set of the publications of the office were also shown. A number of names of persons interested were secured, and much assistance given by way of explanation of the material at hand. After making the last exhibition the material was moved into a room adjoining this office in the State House, where it is being used for demonstration purposes.

## Co-operation with the United States Forest Service.

The State Forester wishes here to acknowledge the hearty co-operation that Mr. Gifford Pinchot and his able assistants have rendered whenever called upon. When requests have gone in to the United States Forest Service for assistance on examinations, lectures, etc., from Massachusetts, they have been referred to this office by the Forest Service, and we have gladly co-operated in the work.

## Examination of Woodlands and Practical Assistance given Owners.

This work has been one of the strong features of the office from the first, and nothing has been left unturned to make the work effective and helpful to as many applicants as we were able to assist during the year.

All the work heretofore done by my predecessor in office was carefully gone over, and in as many cases as possible the actual field examined. In every case of which there is a record in the office, the owner was either seen personally or addressed, in order to know just how effective the assistance has been. Not only was this system carried out with the examinations and assistance of this office, but the United States Forest Service heartily co-operated in sending a complete set of the working plans and names of persons from Massachusetts who had been assisted not only before this office was established but up to the present. This, therefore, gives us the data at hand of practically all of the examinations and assistance given in the State.

After completing the above list, each person receiving assistance was requested to furnish an up-to-date report of just what he had actually accomplished. The information thus received has been very valuable in guiding the work this year. Unfortunately, there were many instances where the assistance has resulted in nothing but an expense to the State, in that there seems to be little likelihood of its ever being made use of. This is particularly true of some of the most elaborate and expensive work this office has done. After trying to renew an interest in carrying out the original plan of these earlier applicants, the attention of the office was turned to the assistance of new applicants.

There were found to be 86 citizens on record as having had woodland examinations. Of this number, 41 replies were received, 23 of which were carrying out the suggestions offered, and 8 wished further assistance. Upon studying the problem, it was found that to make the work effective something more than just a working plan and the giving of written advice are necessary to accomplish the success desired.

Mr. J. J. Dearborn of the Harvard Forestry School, and a young man of much practical forestry experience, was put in charge of this work. We followed out the policy of first meeting the owner upon his property, and of going over the proposed woodland proposition and getting as near as possible his needs and purposes. We then interested him in so far as practicable to determine what should and could be done, provided further plans and assistance were given. We have made 37 new examinations during the past year. Of this number, 33 are following out or contemplating the advice given. By contemplating is meant that they have already placed orders for seedlings, or shown definite indications of doing something either this winter or next spring.

Markings for thinnings have been made over different tracts, amounting in area to some 50 to 100 acres. In almost every case where a thinning was advised, enough was actually done to convey, as an example, the right idea to the owner.

The actual superintendence of the thinning out of one tract has been performed by the office, in order to demonstrate its practicability and secure definite data which is to be used in illustrating methods and results.

The largest tract that the office has undertaken is one of 1,600 acres, in the Berkshires. The field work and data have been secured for this tract, but the making of the map and report of office work end is still in progress. As a result of our assistance, the owner of this tract has employed as a permanent forester a graduate of the Harvard Forestry School of last year. The other tracts examined have been much smaller in area, although a number are of fair proportions, as Massachusetts woodlands run.

We have now several new applications on hand for examinations, one application for a working plan, and some requests for markings for thinnings.

In order to keep in touch with the cost of operations and stumpage values, circular letters and schedules to be filled out have been sent to the lumbermen and dealers in different sections of the State.

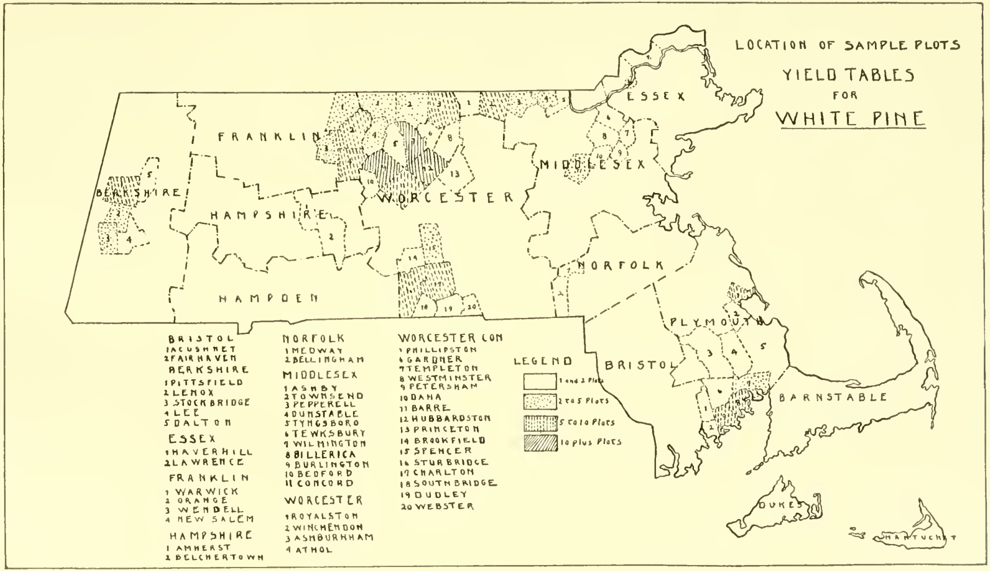
## Technological Work.

During the past summer measurements were made by this office looking towards the construction of a yield table for white pine. A yield table is one which shows the amount of wood per acre that one can expect to obtain from pure even-aged stands of pine at different ages and for different localities. It is especially valuable to predict the yield of planted stands, since such stands are most likely to fulfill the conditions of the table. To make such a table it is necessary to select a large number of sample plots, one-quarter or one-eighth acre in size, taking care that the plots represent a great variety of ages, and as broad a range of locality and growing conditions as one can expect to find in a State of the size of Massachusetts. All the trees on the sample plots are measured for diameter and height, and the amount of lumber in each obtained from volume tables.

This work was in charge of Mr. H. O. Cook of this office, who had the assistance of Messrs. W. G. Howard and R. F. Weston of the Harvard Forest School, and Mr. R. C. Hall of the Yale Forest School. During two months, July and August, they measured one hundred and seventy-eight plots, in fifty-two towns. The accompanying map shows the towns and gives a clue to the number of plots measured in each. Other towns were visited, but as no plots were measured in them, no record of them was kept.

The travelling was largely done on foot; wood-using factories were visited, fire wards interviewed, and in various ways a great deal of general but valuable information on the forest growth, lumber prices, and on other subjects of interest to foresters was picked up and made note of.

The accompanying map is not alone useful in connection with the yield table work, but it gives some clue to the pine distribution in the State. The sections visited were naturally the leading pine-growing regions, and within these regions the amounts in the different towns are roughly proportional to the number of sample plots measured in those towns. The region of greatest production is in the northern part of Worcester County, together


ESSEX
MIDDLESEX
FRANKLIN
BERKSHIRE
HAMPSHIRE
WORCESTER
NORFOLK
HAMPDEN
PLYMOUTH
BRISTOL
BARNSTABLE
DUKES
NANTUCKET
BRISTOL
1 ACUSHNET
2 FAIRHAVEN
BERKSHIRE
1 PITTSFIELD
2 LENOX
3 STOCKBRIDGE
4 LEE
5 DALTON
ESSEX
1 HAVERHILL
2 LAWRENCE
FRANKLIN
1 WARWICK
2 ORANGE
3 WENDELL
4 NEW SALEM
HAMPSHIRE
1 AMHERST
2 BELCHERTOWN
NORFOLK
1 MEDWAY
2 BELLINGHAM
MIDDLESEX
1 ASHBY
2 TOWNSEND
3 PEPPERELL
4 DUNSTABLE
5 TYNGSBORO
6 TEWKSBURY
7 WILMINGTON
8 BILLERICA
9 BURLINGTON
10 BEDFORD
11 CONCORD
WORCESTER
1 ROYALSTON
2 WINCHENDON
3 ASHBURNHAM
4 ATHOL
WORCESTER CON
5 PHILLIPSTON
6 GARDNER
7 TEMPLETON
8 WESTMINSTER
9 PETERSHAM
10 DANA
11 BARRE
12 HUBBARDSTON
13 PRINCETON
14 BROOKFIELD
15 SPENCER
16 STURBRIDGE
17 CHARLTON
18 SOUTHBRIDGE
19 DUDLEY
20 WEBSTER
LEGEND
1 and 2 Plots
2 to 5 Plots
5 to 10 Plots
10 plus Plots

LOCATION OF SAMPLE PLOTS

YIELD TABLES
FOR
WHITE PINE

with adjoining portions of Franklin and Middlesex counties. Petersham, where twenty-three sample plots were measured, is the banner town of this region and of the State.

The growth of individual pine trees, as well as the growth of acre stands has been studied by making what are known to foresters as stem analyses on more than two hundred and fifty trees. Where cutting is going on, trees are selected and the separate logs are measured for length, diameter and the growth for ten-year periods, as shown by the annual rings. The growth of the various logs together with the stump and the top when put together make up the growth of the entire tree. The individual trees are then assigned to certain types of growth, and tables constructed which will show the rate of growth of pine under varying conditions, and its rate of growth at different ages.

The yield tables, the growth tables and other information concerning the white pine as it grows in this State will soon be published in bulletin form.

*Yield per Acre from thinning Pure, fully stocked White Pine.*

| Age (Years). | Trees Five Inches or More in Diameter. | | | | All Trees. | | | |
|---|---|---|---|---|---|---|---|---|
| | Board Feet. | Stumpage at $6 per M. | Value at $16 per M. | Cubic Feet. | Cords. | Value at $5 per Cord. | Stumpage at $4 per Cord. | Cubic Feet. |
| 25, . | 1,400 | $8 40 | $22 40 | 280 | 11.0 | $55 00 | $44 00 | 880 |
| 30, . | 3,700 | 22 20 | 59 20 | 720 | 12.0 | 60 00 | 48 00 | 1,040 |
| 35, . | 4,950 | 29 70 | 79 20 | 850 | 12.3 | 61 50 | 49 20 | 1.090 |
| 40, . | 6,000 | 36 00 | 96 00 | 1,030 | 12.8 | 64 00 | 51 20 | 1,150 |
| 45, . | 6,800 | 40 80 | 108 80 | 1,140 | 13.0 | 65 00 | 52 00 | 1,190 |
| 50, . | 7,400 | 44 40 | 118 40 | 1,240 | 13.4 | 67 00 | 53 60 | 1,240 |
| 55, . | 7,900 | 49 40 | 126 40 | 1,310 | 14.0 | 70 00 | 56 00 | 1,310 |

The above table shows the yield to be obtained by thinning white pine stands of different ages in cases where the stand is pure, containing no other trees but white pine, and fully stocked, — that is, without pronounced holes or blanks.

The table is divided into two parts, one for trees five inches or more in breast-high diameter, the volumes of which are indicated in broad measure. The corresponding money values are given,— in the second column the stumpage value at $6 per thousand, and in the third column the value of the lumber at $16 per thousand. The stumpage value is purposely put low, because in general the material taken out in thinnings is not of the highest quality, and is more expensive to get out than if the stand is cut clean.

In the second part trees of all sizes are included, and their volume is given in cords. Stumpage is reckoned at the rate of $4 a cord. The value ($5) used in the second column is the price usually obtained by owners who cut and haul their own wood to the mill in small lots. If $1 is allowed for the labor of chopping and $1 for the hauling, it will be seen that by this method the farmer gets a stumpage rate of only $3, which is less than the common rate. This method of operating, however, has certain advantages in making thinnings: first, because any quantity of material, no matter how small, can be cut and sold; second, the cutting, when done by the owner, is sure to be done carefully, and this is important in making thinnings; third, if the work is done during the winter, when the farmer and his team have little to do, the entire $5 can be regarded as clear profit.

## Forest Map.

Two years ago the State Forester started the construction of a forest map of the State, through the agency of the census department. Agents of this department were provided with maps of all the towns in the State, visited the assessors of each town, and from their collective knowledge had them sketch on the maps the forest area, with notes on the kind of growth thereon. This method is at best rather a crude form of map making, and the data inaccurate, even though many of the maps have been corrected by members of this office. Until a more costly and better map can be made, however, it provides our best means for getting at the forest growth of the State and its area. The forest area so taken has been measured by this office, and the results of these measurements are given in the adjoined list.

The growth is divided into three main types: the pine type, — woodland containing over seventy-five per cent white pine; woodland consisting wholly of hard woods; and a mixed type of hard woods, in which are scattering pines and perhaps other conifers, as spruce and hemlock. In the last column are placed some miscellaneous growths, not of great importance in the aggregate, but prominent in the towns in which they are situated.

Scrub means land covered with acorn brush, or a land covered with young growth of no commercial value.

Pitch pine, in Barnstable, Dukes and Nantucket counties, is put in the pine type.

The cedar referred to is the white cedar (*Chamæcyparis thyoides*) of the swamps, and not the red cedar.

In drawing conclusions from these figures, it is to be noted that the larger the area used the more accurate will the results be; that is, the figures for a county are more accurate than those for a town, and those for the State more accurate than the figures for any county. The columns of per cent which give the amount of forest land relative to the total area, or the amount of land in each type relative to the total *forest* area, offer a better means of comparing different towns or counties than the figures of acreage.

Thirty-seven per cent of the acreage of the State is in forest land; but if Suffolk and Nantucket counties are omitted, the percentage is raised to forty. We add to this an amount sufficient to make up for waste land that should be in forest, and we have about fifty per cent of the total area of the State available for forest purposes.

## *Barnstable County.*

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Barnstable, | 40,367 | 20,447 | 51.0 | – | – | – | – | 15,744 [1] | 71.0 | 4.733 [2] | 29.0 |
| Bourne, | 26,584 | 17,792 | 67.0 | – | – | – | – | 14,400 | 82.0 | 3,392 [2] | 18.0 |
| Brewster, | 16,103 | 8,480 | 53.0 | – | – | – | – | 8,480 [1] | 100.0 | – | – |
| Chatham, | 10,442 | 1,754 | 17.0 | – | – | – | – | 1,619 | – | 135 [2] | 8.0 |
| Dennis, | 14,016 | 6,496 | 46.0 | – | – | – | – | 4,128 [1] | 65.0 | 2,368 [2] | 35.0 |
| Eastham, | 9,341 | 2,688 | 29.0 | 2,170 [3] | 95.0 | – | – | – | – | 520 [2] | 5.0 |
| Falmouth, | 29,260 | 21,344 | 73.0 | – | – | – | – | 10,976 [1] | 50.0 | 10,368 [2] | 50.0 |
| Harwich, | 14,340 | 8,800 | 61.0 | 2,790 [3] | 25.0 | – | – | 5,120 [1] | 65.0 | 895 [2] | 10.0 |
| Mashpee, | 16,617 | 13,217 | 80.0 | 2,855 [3] | 20.0 | 1,375 | 10.0 | 8,820 | 70.0 | – | – |
| Orleans, | 9,081 | 1,517 | 17.0 | 128 [3] | 9.0 | 493 | 33.0 | 864 | 56.0 | – | – |
| Provincetown, | 5,600 | 960 | 17.0 | – | – | 64 | 8.0 | 896 | 92.0 | – | – |
| Sandwich, | 28,033 | 18,850 | 67.0 | – | – | 4,450 | 3.0 | 18,400 | 97.0 | – | – |
| Truro, | 13,825 | 5,360 | 40.0 | – | – | – | – | 160 [4] | 3.0 | 5,200 [2] | 97.0 |
| Wellfleet, | 13,326 | 2,830 | 48.0 | 1,517 [3] | 52.0 | – | – | 320 | 12.0 | 990 [2] | 36.0 |
| Yarmouth, | 16,338 | 9,600 | 51.0 | 3,810 [3] | 40.0 | – | – | 5,280 | 45.0 | 512 [2] | 15.0 |
| Totals, | 263,273 | 140,135 | 53.0 | 13,270 | 9.4 | 6,382 | 4.6 | 95,207 | 68.0 | 29,113 | 18.0 |

## *Berkshire County.*

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Adams, | 14,976 | 8,436 | 56.0 | 416 | 5.0 | 90 | 1.0 | 7,930 | 94.0 | – | – |
| Alford, | 7,104 | 2,708 | 38.0 | 96 | 3.0 | 2,272 | 84.0 | 340 | 13.0 | – | – |
| Becket, | 32,896 | 19,771 | 60.0 | – | – | 2,413 | 12.0 | 16,583 | 84.0 | 775 [5] | 4.0 |
| Cheshire, | 18,304 | 10,419 | 57.0 | 1,216 | 12.0 | 3,564 | 34.0 | 5,287 | 51.0 | 352 [5] | 3.0 |
| Clarksburg, | 7,936 | 6,831 | 76.0 | – | – | 4,872 | 74.0 | 1,959 | 26.0 | – | – |
| Dalton, | 13,824 | 8,749 | 63.0 | – | – | – | – | 8,749 | 100.0 | – | – |
| Egremont, | 12,224 | 4,896 | 40.0 | 512 | 10.0 | 3,970 | 82.0 | 256 | 5.0 | 128 [6] | 3.0 |
| Florida, | 12,800 | 10,389 | 84.0 | – | – | 378 | 3.0 | 7,136 | 69.0 | 2,875 [7] | 28.0 |
| Great Barrington, | 31,168 | 14,377 | 46.0 | 256 | 2.0 | 11,648 | 81.0 | 2,395 | 17.0 | – | – |
| Hancock, | 24,128 | 15,306 | 63.0 | – | – | 14,074 | 92.0 | 1,102 | 7.0 | 130 [7] | 1.0 |
| Hinsdale, | 13,696 | 8,160 | 59.0 | 32 | – | – | – | 4,608 | 56.0 | 3,520 [7] | 41.0 |
| Lanesborough, | 18,816 | 9,205 | 49.0 | 1,274 | 14.0 | 4,961 | 54.0 | 2,560 | 28.0 | 410 [7] | 4.0 |
| Lee, | 16,256 | 9,832 | 60.0 | 640 | 6.0 | 1,051 | 12.0 | 8,032 | 82.0 | – | – |
| Lenox, | 15,360 | 7,900 | 51.0 | 832 | 11.0 | 4,033 | 51.0 | 2,778 | 36.0 | 257 [5] | 2.0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Monterey, | 17,048 | 9,672 | 57.0 | 1,396 | 14.0 | 7,040 | 73.0 | 1,236 | 13.0 | – | – |
| Mount Washington, | 14,400 | 13,132 | 91.0 | 352 | 3.0 | 12,652 | 96.0 | – | – | 147[5] | 1.0 |
| New Ashford, | 8,320 | 6,822 | 82.0 | – | – | – | – | 6,720 | 98.0 | 102[7] | 2.0 |
| New Marlborough, | 30,976 | 13,690 | 44.0 | 800 | 6.0 | 4,813 | 35.0 | 7,168 | 53.0 | 909[5] | 6.0 |
| North Adams, | 12,160 | 6,701 | 55.0 | – | – | 941 | 15.0 | 5,536 | 82.0 | 221[7] | 3.0 |
| Otis, | 24,192 | 12,055 | 50.0 | 2,227 | 19.0 | 6,961 | 57.0 | 2,867 | 24.0 | – | – |
| Peru, | 17,344 | 8,480 | 49.0 | – | – | 2,848 | 34.0 | 1,408 | 16.0 | 4,224[7] | 50.0 |
| Pittsfield, | 26,944 | 7,981 | 29.0 | 928 | 12.0 | 6,061 | 76.0 | 992 | 12.0 | – | – |
| Richmond, | 11,776 | 5,862 | 50.0 | 736 | 13.0 | 1,696 | 29.0 | 3,292 | 56.0 | 134[6] | 2.0 |
| Sandisfield, | 33,984 | 17,984 | 53.0 | 192 | 1.0 | 6,656 | 37.0 | 11,136 | 62.0 | – | – |
| Savoy, | 25,152 | 13,875 | 55.0 | 96 | 1.0 | – | – | 9,888 | 71.0 | 3,891[5] | 28.0 |
| Sheffield, | 32,448 | 12,844 | 39.0 | 1,120 | 9.0 | 7,040 | 54.0 | 4,384 | 34.0 | 300[7] | 3.0 |
| Stockbridge, | 14,144 | 5,152 | 36.0 | 288 | 6.0 | 4,736 | 92.0 | – | – | 128[7] | 2.0 |
| Tyringham, | 12,800 | 7,763 | 61.0 | 346 | 5.0 | 6,668 | 86.0 | 749 | 9.0 | – | – |
| Washington, | 25,280 | 18,134 | 72.0 | 282 | 2.0 | 11,494 | 63.0 | 4,576 | 25.0 | 1,741[7] | 10.0 |
| West Stockbridge, | 11,648 | 5,453 | 47.0 | – | – | 4,525 | 83.0 | 928 | 17.0 | – | – |
| Williamstown, | 31,360 | 18,477 | 59.0 | 128 | 1.0 | 7,552 | 41.0 | 8,928 | 48.0 | 1,869[6] | 10.0 |
| Windsor, | 21,440 | 9,018 | 42.0 | 192 | 2.0 | 5,549 | 62.0 | 576 | 6.0 | 2,701[5] | 30.0 |
| Totals, | 630,904 | 330,074 | 54.0 | 14,357 | 4.0 | 150,558 | 47.0 | 140,099 | 42.0 | 24,917 | 7.0 |

*Bristol County.*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Acushnet, | 12,041 | 2,778 | 23.0 | 698 | 25.0 | – | – | 1,184 | 42.0 | 896[2] | 33.0 |
| Attleborough, | 17,774 | 2,804 | 16.0 | 96 | 3.0 | 1,428 | 50.0 | 1,280 | 47.0 | – | – |
| Berkley, | 10,496 | 1,748 | 17.0 | 340 | 20.0 | – | – | 1,408 | 80.0 | – | – |
| Dartmouth, | 39,578 | 20,606 | 50.0 | 640 | 3.0 | 6,458 | 31.0 | 11,098 | 54.0 | 2,410[2] | 12.0 |
| Dighton, | 14,306 | 1,255 | 9.0 | 32 | 3.0 | 192 | 15.0 | 1,031 | 82.0 | – | – |
| Easton, | 18,845 | 12,194 | 65.0 | 39 | – | 1,440 | 11.0 | 7,533 | 61.0 | 3,182[2] | 28.0 |
| Fairhaven, | 7,934 | 1,517 | 19.0 | 269 | 17.0 | 1,152 | 77.0 | 96 | 6.0 | – | – |
| Fall River, | 24,372 | 5,152 | 21.0 | 320 | 6.0 | 1,984 | 38.0 | 1,056 | 20.0 | 1,792[8] | 36.0 |
| Freetown, | 23,173 | 6,791 | 29.0 | 1,696 | 25.0 | – | – | 4,429 | 65.0 | 666[8] | 10.0 |
| Mansfield, | 13,012 | 8,000 | 61.0 | 83 | 1.0 | 896 | 11.0 | 6,893 | 86.0 | 1,440[8] | 61.0 |
| New Bedford, | 12,669 | 2,432 | 19.0 | 192 | 8.0 | – | – | 800 | 33.0 | 653[2] | 28.0 |
| North Attleborough, | 12,452 | 2,253 | 18.0 | 192 | 8.0 | 704 | 32.0 | 704 | 32.0 | 32[2] | – |
| Norton, | 18,817 | 7,052 | 38.0 | 96 | 1.0 | 928 | 14.0 | 5,996 | 85.0 | 736[8] | 10.0 |
| Raynham, | 13,263 | 7,839 | 59.0 | 154 | 2.0 | 1,760 | 23.0 | 5,189 | 65.0 | – | – |

---

[1] Pitch pine and hardwoods mixed.
[2] Scrub growth.
[3] Pitch pine.
[4] Pitch pine and cedar mixed.
[5] Spruce and hemlock mixed.
[6] Hemlock growth.
[7] Spruce growth.
[8] Cedar swamp.

## *Bristol County* — Concluded.

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rehoboth, | 30,372 | 7,117 | 23.0 | 640 | 12.0 | 2,250 | 30.0 | 4,225 | – | – | – |
| Seekonk, | 11,957 | 1,856 | 16.0 | – | – | 147 | 8.0 | 1,709 | 92.0 | 90[1] | 8.0 |
| Somerset, | 5,546 | 730 | 13.0 | – | – | – | – | 640 | 92.0 | – | – |
| Swansea, | 14,587 | 1,011 | 7.0 | – | – | 1,011 | 100.0 | – | – | – | – |
| Taunton, | 31,099 | 14,445 | 45.0 | 160 | 1.0 | 2,349 | 16.0 | 11,008 | 77.0 | 928[1] | 6.0 |
| Westport, | 35,349 | 9,613 | 27.0 | 512 | 5.0 | 1,325 | 14.0 | 6,304 | 66.0 | 1,412[1] | 15.0 |
| Totals, | 367,642 | 117,193 | 32.0 | 6,149 | 5.0 | 24,024 | 20.0 | 72,583 | 68.0 | 14,300 | 16.0 |

## *Dukes County.*

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chilmark, | 14,181 | 3,975 | 28.0 | – | – | – | – | 2,995 | 75.0 | 980[1] | 25.0 |
| Edgartown, | 18,718 | 6,920 | 37.0 | – | – | 2,407 | 30.0 | 3,170 | 48.0 | 1,345[1] | 22.0 |
| Gay Head, | 4,062 | 378 | 9.0 | – | – | 290 | 75.0 | – | – | 90[1] | 25.0 |
| Gosnold, | 8,286 | 1,410 | 17.0 | 130[2] | 9.0 | 320 | 21.0 | 960 | 70.0 | – | – |
| Oak Bluffs, | 4,642 | 1,568 | 34.0 | – | – | – | – | 1,408 | 90.0 | 160[1] | 10.0 |
| Tisbury, | 4,825 | 2,080 | 43.0 | – | – | 1,280 | 60.0 | 8,000[2] | 40.0 | – | – |
| West Tisbury, | 17,072 | 7,455 | 44.0 | 192[2] | 3.0 | – | – | 1,825 | 87.0 | 735[1] | 10.0 |
| Totals, | 71,786 | 23,786 | 33.0 | 322 | 1.5 | 4,297 | 17.0 | 18,358 | 77.0 | 3,310 | 15.0 |

## *Essex County.*

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amesbury, | 8,841 | 1,961 | 22.0 | 519 | 26.0 | 1,442 | 74.0 | – | – | – | – |
| Andover, | 20,471 | 6,575 | 33.0 | 954 | 15.0 | 4,237 | 64.0 | 1,294 | 21.0 | – | – |
| Beverly, | 7,781 | 3,264 | 45.0 | 320 | 10.0 | – | – | 2,944 | 90.0 | – | – |
| Boxford, | 15,611 | 9,668 | 66.0 | 868 | 9.0 | 5,056 | 52.0 | 3,744 | 39.0 | – | – |
| Danvers, | 8,857 | 1,647 | 18.0 | 131 | 8.0 | 288 | 18.0 | 1,178 | 74.0 | – | – |
| Essex, | 9,201 | 3,264 | 35.0 | – | – | – | – | 3,264 | 100.0 | – | – |
| Georgetown, | 8,496 | 4,621 | 54.0 | 160 | 4.0 | 3,341 | 72.0 | 1,120 | 24.0 | – | – |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gloucester, | 16,929 | 5,963 | 35.0 | 77 | 1.0 | 154 | 3.0 | 5,732 | 96.0 | – | – |
| Groveland, | 5,994 | 3,565 | 60.0 | 256 | 7.0 | 461 | 13.0 | 2,848 | 80.0 | – | – |
| Hamilton, | 9,594 | 3,776 | 39.0 | 32 | 1.0 | 256 | 7.0 | 3,488 | 92.0 | – | – |
| Haverhill, | 22,818 | 3,207 | 14.0 | 576 | 18.0 | 935 | 29.0 | 1,696 | 53.0 | – | – |
| Ipswich, | 21,340 | 5,448 | 26.0 | – | – | 2,228 | 40.0 | 3,220 | 60.0 | – | – |
| Lawrence, | 4,636 | 1,198 | 26.0 | 115 | 10.0 | 1,011 | 84.0 | 71 | 6.0 | – | – |
| Lynn, | 7,177 | 2,798 | 42.0 | – | – | – | – | 2,798 | 100.0 | – | – |
| Lynnfield, | 6,713 | 3,514 | 52.0 | – | – | 589 | 17.0 | 2,925 | 83.0 | – | – |
| Manchester, | 4,940 | 2,791 | 57.0 | – | – | – | – | 2,791 | 100.0 | – | – |
| Marblehead, | 2,831 | 269 | 9.0 | – | – | – | – | 269 | 100.0 | – | – |
| Merrimac, | 5,778 | 1,946 | 33.0 | 378 | 19.0 | 448 | 24.0 | 1,120 | 57.0 | – | – |
| Methuen, | 14,752 | 5,070 | 34.0 | 96 | 2.0 | 2,605 | 51.0 | 2,369 | 47.0 | – | – |
| Middleton, | 9,256 | 6,568 | 71.0 | 359 | 6.0 | 4,532 | 69.0 | 1,677 | 25.0 | – | – |
| Nahant, | 680 | – | – | – | – | – | – | – | – | – | – |
| Newbury, | 15,577 | 2,368 | 15.0 | 32 | 1.0 | 2,240 | 95.0 | – | – | 96[2] | 4.0 |
| Newburyport, | 5,696 | 685 | 12.0 | 256 | 37.0 | 429 | 63.0 | – | – | – | – |
| North Andover, | 17,810 | 7,277 | 41.0 | 160 | 2.0 | 6,669 | 92.0 | 448 | 6.0 | – | – |
| Peabody, | 10,758 | 4,717 | 44.0 | 352 | 7.0 | 4,365 | 93.0 | – | – | – | – |
| Rockport, | 4,529 | 1,010 | 22.0 | 58 | 6.0 | 37 | 4.0 | 915 | 90.0 | – | – |
| Rowley, | 12,180 | 2,415 | 20.0 | – | – | 1,103 | 46.0 | 1,312 | 54.0 | – | – |
| Salem, | 5,233 | 2,077 | 40.0 | – | – | – | – | 384 | 18.0 | 1,692[3] | 82.0 |
| Salisbury, | 10,325 | 2,446 | 24.0 | – | – | 96 | 4.0 | 2,350 | 96.0 | – | – |
| Saugus, | 7,412 | 2,112 | 28.0 | – | – | 544 | 26.0 | 1,568 | 74.0 | – | – |
| Swampscott, | 1,981 | 864 | 44.0 | – | – | – | – | 864 | 100.0 | – | – |
| Topsfield, | 8,228 | 2,650 | 32.0 | 154 | 6.0 | 301 | 11.0 | 2,195 | 83.0 | – | – |
| Wenham, | 5,252 | 1,241 | 24.0 | 38 | 3.0 | – | – | 1,203 | 97.0 | – | – |
| West Newbury, | 9,381 | 1,062 | 11.0 | – | – | 1,062 | 100.0 | – | – | – | – |
| Totals, | 326,660 | 108,537 | 33.0 | 5,891 | 4.0 | 44,429 | 43.0 | 55,787 | 51.0 | 2,688 | 2.0 |

*Franklin County.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashfield, | 25,408 | 9,325 | 37.0 | 128 | 1.0 | 2,208 | 24.0 | 6,989 | 75.0 | – | – |
| Bernardston, | 14,144 | 4,864 | 34.0 | 32 | – | – | – | 4,832 | 100.0 | – | – |
| Buckland, | 12,864 | 5,908 | 46.0 | – | – | – | – | 5,908 | 100.0 | – | – |
| Charlemont, | 16,896 | 8,052 | 48.0 | – | – | – | – | 8,052 | 100.0 | – | – |
| Colrain, | 20,480 | 15,866 | 77.0 | – | – | 6,464 | 41.0 | 9,402 | 59.0 | – | – |
| Conway, | 24,128 | 10,708 | 44.0 | 192 | 2.0 | 5,172 | 48.0 | 5,344 | 50.0 | – | – |

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[1] Scrub growth.

[2] Pitch pine.

[3] Cedar swamp.

## *Franklin County* — Concluded.

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Deerfield, | 22,528 | 9,511 | 42.0 | 423 | 5.0 | – | – | 9,088 | 95.0 | – | – |
| Erving, | 9,216 | 3,873 | 42.0 | 77 | 2.0 | 1,044 | 28.0 | 2,752 | 70.0 | – | – |
| Gill, | 9,344 | 1,613 | 17.0 | 480 | 29.0 | 877 | 54.0 | 256 | 17.0 | – | – |
| Greenfield, | 12,800 | 2,624 | 21.0 | – | – | 448 | 16.0 | 2,176 | 84.0 | – | – |
| Hawley, | 19,712 | 9,184 | 47.0 | – | – | 768 | 9.0 | 8,416 | 91.0 | – | – |
| Heath, | 16,000 | 5,549 | 35.0 | – | – | 960 | 17.0 | 4,589 | 83.0 | – | – |
| Leverett, | 14,232 | 6,356 | 45.0 | 256 | 4.0 | 448 | 7.0 | 5,652 | 89.0 | – | – |
| Leyden, | 18,240 | 3,956 | 22.0 | – | – | 1,204 | 32.0 | 2,752 | 68.0 | – | – |
| Monroe, | 7,104 | 4,397 | 62.0 | – | – | 173 | 4.0 | 2,317 | 53.0 | 1,907 [1] | 43.0 |
| Montague, | 19,456 | 4,841 | 24.0 | – | – | 1,184 | 24.0 | 3,657 | 76.0 | – | – |
| New Salem, | 19,264 | 9,018 | 46.0 | 3,789 | 38.0 | 813 | 9.0 | 4,416 | 45.0 | 880 [2] | 9.0 |
| Northfield, | 22,784 | 6,650 | 29.0 | 288 | 4.0 | 2,599 | 39.0 | 3,763 | 57.0 | – | – |
| Orange, | 23,684 | 10,208 | 43.0 | 1,683 | 17.0 | 4,096 | 40.0 | 4,429 | 43.0 | – | – |
| Rowe, | 15,424 | 6,816 | 44.0 | – | – | 288 | 4.0 | 6,528 | 96.0 | – | – |
| Shelburne, | 15,104 | 6,720 | 44.0 | 384 | 6.0 | – | – | 6,336 | 94.0 | – | – |
| Shutesbury, | 17,024 | 9,479 | 55.0 | 115 | 1.0 | 429 | 4.0 | 8,935 | 95.0 | – | – |
| Sunderland, | 8,960 | 1,472 | 17.0 | 128 | 1.0 | – | – | 1,344 | 99.0 | – | – |
| Warwick, | 23,936 | 10,112 | 42.0 | 1,824 | 18.0 | 435 | 4.0 | 7,853 | 78.0 | – | – |
| Wendell, | 20,672 | 5,664 | 27.0 | 474 | 9.0 | 2,592 | 45.0 | 2,598 | 46.0 | – | – |
| Whately, | 12,160 | 1,683 | 14.0 | – | – | 1,683 | 100.0 | – | – | – | – |
| Totals, | 441,560 | 224,849 | 50.0 | 10,273 | 4.0 | 34,085 | 39.0 | 128,385 | 57.0 | 2,787 | 2.0 |

## *Hampden County.*

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Agawam, | 16,000 | 2,996 | 19.0 | 352 | 11.0 | 1,364 | 46.0 | 1,280 | 43.0 | – | – |
| Blandford, | 33,920 | 13,550 | 40.0 | 429 | 4.0 | 7,271 | 53.0 | 5,850 | 43.0 | – | – |
| Brimfield, | 22,528 | 8,385 | 37.0 | 224 | 3.0 | 3,533 | 42.0 | 4,628 | 55.0 | – | – |
| Chester, | 23,040 | 12,096 | 52.0 | – | – | 7,424 | 61.0 | 4,672 | 39.0 | – | – |
| Chicopee, | 16,448 | 2,292 | 14.0 | 84 | 4.0 | 2,112 | 92.0 | – | – | 96 [3] | 4.0 |
| East Longmeadow, | 8,576 | 590 | 7.0 | 276 | 49.0 | 150 | 22.0 | 164 | 29.0 | – | – |
| Granville, | 28,992 | 10,977 | 38.0 | 160 | 1.0 | 564 | 5.0 | 10,253 | 94.0 | – | – |
| Hampden, | 12,160 | 4,365 | 36.0 | 52 | 1.0 | 473 | 11.0 | 3,840 | 88.0 | – | – |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Holland, | 8,640 | 3,733 | 43.0 | 135 | 4.0 | 3,213 | 86.0 | 365 | 10.0 | – | – |
| Holyoke, | 10,752 | 2,794 | 26.0 | – | – | – | – | 2,794 | 100.0 | – | – |
| Longmeadow, | 7,168 | 310 | 4.0 | 32 | 10.0 | 182 | 59.0 | 96 | 31.0 | – | – |
| Ludlow, | 18,048 | 1,965 | 11.0 | 269 | 19.0 | 768 | 34.0 | 928 | 47.0 | – | – |
| Monson, | 30,592 | 9,780 | 32.0 | 141 | 2.0 | 7,495 | 76.0 | 2,144 | 22.0 | – | – |
| Montgomery, | 9,600 | 8,032 | 83.0 | – | – | – | – | 8,032 | 100.0 | – | – |
| Palmer, | 20,800 | 10,093 | 48.0 | 128 | 1.0 | 9,965 | 99.0 | – | – | – | – |
| Russell, | 12,160 | 6,266 | 51.0 | – | – | 1,152 | 18.0 | 4,570 | 73.0 | 544[3] | 19.0 |
| Southwick, | 14,784 | 3,552 | 24.0 | – | – | 1,517 | 43.0 | 2,035 | 57.0 | 1,216[2] | 20.0 |
| Springfield, | 20,608 | 6,106 | 29.0 | – | – | – | – | 4,890 | 80.0 | – | – |
| Tolland, | 20,032 | 9,498 | 47.0 | 1,632 | 17.0 | 1,024 | 11.0 | 6,842 | 72.0 | – | – |
| Wales, | 10,624 | 2,432 | 23.0 | – | – | 2,144 | 88.0 | 288 | 12.0 | – | – |
| West Springfield, | 11,712 | 2,306 | 20.0 | 102 | 5.0 | 192 | 8.0 | 2,012 | 87.0 | – | – |
| Westfield, | 31,040 | 2,912 | 8.0 | – | – | 128 | 5.0 | 2,784 | 95.0 | – | – |
| Wilbraham, | 14,720 | 2,891 | 20.0 | – | – | 1,427 | 49.0 | 1,402 | 49.0 | 62[3] | 2.0 |
| Totals, | 412,934 | 127,891 | 31.0 | 4,016 | 6.0 | 52,998 | 41.0 | 69,870 | 51.0 | 1,822 | 2.0 |

## *Hampshire County.*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Amherst, | 17,280 | 2,663 | 15.0 | 228 | 11.0 | 1,485 | 56.0 | 890 | 33.0 | – | – |
| Belchertown, | 35,264 | 13,415 | 38.0 | 365 | 3.0 | 3,021 | 22.0 | 10,029 | 75.0 | – | – |
| Chesterfield, | 20,736 | 8,224 | 39.0 | – | – | 1,888 | 23.0 | 6,336 | 77.0 | – | – |
| Cummington, | 14,592 | 10,973 | 75.0 | – | – | – | – | 10,480 | 96.0 | 493[4] | 4.0 |
| Easthampton, | 9,152 | 2,976 | 32.0 | – | – | – | – | 2,976 | 100.0 | – | – |
| Enfield, | 11,200 | 5,005 | 45.0 | – | – | 2,861 | 57.0 | 2,144 | 43.0 | – | – |
| Goshen, | 10,944 | 3,905 | 36.0 | 244 | 6.0 | 589 | 16.0 | 3,070 | 78.0 | – | – |
| Granby, | 17,600 | 4,295 | 24.0 | – | – | 2,727 | 63.0 | 1,568 | 37.0 | – | – |
| Greenwich, | 12,800 | 3,648 | 29.0 | – | – | 704 | 20.0 | 2,944 | 80.0 | – | – |
| Hadley, | 15,872 | 1,691 | 11.0 | – | – | 302 | 18.0 | 1,389 | 82.0 | – | – |
| Hatfield, | 11,072 | 3,520 | 32.0 | – | – | – | – | 3,520 | 100.0 | – | – |
| Huntington, | 17,408 | 7,060 | 40.0 | – | – | 2,208 | 32.0 | 4,852 | 68.0 | – | – |
| Middlefield, | 15,488 | 9,792 | 63.0 | – | – | 3,680 | 38.0 | 6,112 | 62.0 | – | – |
| Northampton, | 25,920 | 7,277 | 28.0 | – | – | 7,277 | 100.0 | – | – | – | – |
| Pelham, | 16,064 | 7,654 | 47.0 | – | – | 832 | 12.0 | 6,822 | 88.0 | 525[4] | 8.0 |
| Plainfield, | 13,952 | 6,618 | 47.0 | – | – | 96 | 1.0 | 5,997 | 91.0 | – | – |
| Prescott, | 11,712 | 4,339 | 37.0 | 832 | 19.0 | – | – | 3,507 | 81.0 | – | – |
| South Hadley, | 11,840 | 2,720 | 23.0 | – | – | – | – | 2,720 | 100.0 | – | – |

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[1] Spruce growth. [2] Pitch pine. [3] Hemlock growth. [4] Spruce and hemlock mixed.

## *Hampshire County* — Concluded.

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Southampton, | 17,472 | 10,983 | 63.0 | – | – | – | – | 10,983 | 100.0 | – | – |
| Ware, | 18,752 | 2,904 | 15.0 | – | – | 1,619 | 56.0 | 1,285 | 44.0 | – | – |
| Westhampton, | 17,792 | 11,712 | 65.0 | – | – | 11,712 | 100.0 | – | – | – | – |
| Williamsburg, | 16,320 | 8,730 | 53.0 | 448 | 5.0 | 5,191 | 58.0 | 3,091 | 37.0 | – | – |
| Worthington, | 20,800 | 6,893 | 33.0 | 96 | 1.0 | 806 | 13.0 | 5,991 | 86.0 | – | – |
| Totals, | 380,032 | 146,997 | 38.0 | 2,213 | 2.0 | 46,998 | 32.0 | 96,706 | 65.0 | 1,018 | 1.0 |

## *Middlesex County.*

| City or Town. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acton, | 12,999 | 2,603 | 20.0 | 640 | 24.0 | 1,213 | 46.0 | 750 | 30.0 | – | – |
| Arlington, | 3,577 | 369 | 10.0 | – | – | 231 | 63.0 | 138 | 37.0 | – | – |
| Ashby, | 14,912 | 5,372 | 36.0 | 660 | 12.0 | 2,580 | 48.0 | 2,132 | 40.0 | – | – |
| Ashland, | 23,037 | 1,726 | 8.0 | 26 | 1.0 | 1,501 | 87.0 | 199 | 12.0 | – | – |
| Ayer, | 5,980 | 3,003 | 50.0 | 218 | 7.0 | 1,754 | 59.0 | 1,031 | 34.0 | – | – |
| Bedford, | 8,867 | 4,378 | 49.0 | 480 | 11.0 | 1,818 | 42.0 | 2,080 | 47.0 | – | – |
| Belmont, | 2,981 | 674 | 22.0 | – | – | 674 | 100.0 | – | – | – | – |
| Billerica, | 16,617 | 6,772 | 41.0 | 538 | 9.0 | 2,432 | 35.0 | 3,802 | 56.0 | – | – |
| Boxborough, | 6,648 | 3,021 | 45.0 | 224 | 7.0 | 941 | 31.0 | 1,856 | 62.0 | – | – |
| Burlington, | 7,603 | 2,881 | 38.0 | 116 | 4.0 | 1,325 | 46.0 | 1,440 | 50.0 | – | – |
| Cambridge, | 4,570 | – | – | – | – | – | – | – | – | – | – |
| Carlisle, | 9,884 | 4,071 | 41.0 | 160 | 4.0 | 1,287 | 32.0 | 2,624 | 64.0 | – | – |
| Chelmsford, | 14,693 | 5,768 | 32.0 | 960 | 17.0 | 3,124 | 55.0 | 1,684 | 28.0 | – | – |
| Concord, | 16,492 | 4,705 | – | 461 | 10.0 | 4,052 | 86.0 | 192 | 4.0 | – | – |
| Dracut, | 13,631 | 7,021 | 51.0 | 365 | 5.0 | 2,368 | 33.0 | 4,288 | 62.0 | – | – |
| Dunstable, | 10,993 | 3,060 | 28.0 | 52 | 2.0 | 1,120 | 38.0 | 1,888 | 60.0 | – | – |
| Everett, | 2,396 | – | – | – | – | – | – | – | – | – | – |
| Framingham, | 45,408 | 5,155 | 11.0 | 16 | – | 1,407 | 28.0 | 3,732 | 72.0 | – | – |
| Groton, | 17,278 | 5,741 | 33.0 | – | – | 3,136 | 55.0 | 2,605 | 45.0 | – | – |
| Holliston, | 39,947 | 4,247 | 16.0 | 160 | 4.0 | 2,592 | 61.0 | 1,495 | 35.0 | – | – |
| Hopkinton, | 17,408 | 7,022 | 43.0 | 224 | 3.0 | 5,940 | 85.0 | 653 | 9.0 | 205[1] | 3.0 |
| Hudson, | 7,559 | 3,034 | 40.0 | 52 | 2.0 | 2,226 | 73.0 | 756 | 25.0 | – | – |
| Lexington, | 10,641 | 2,400 | 23.0 | 192 | 8.0 | 1,344 | 56.0 | 864 | 36.0 | – | – |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lincoln, | 9,550 | 3,693 | 37.0 | – | – | 2,637 | 71.0 | 1,056 | 29.0 | – | – |
| Littleton, | 11,104 | 4,736 | 43.0 | 192 | 4.0 | 2,944 | 63.0 | 1,600 | 33.0 | – | – |
| Lowell, | 7,941 | 1,172 | 15.0 | 384 | 33.0 | 435 | 37.0 | 353 | 30.0 | – | – |
| Malden, | 3,285 | 717 | 22.0 | 77 | 11.0 | 608 | 85.0 | 32 | 4.0 | – | – |
| Marlborough, | 14,105 | 3,399 | 24.0 | 263 | 8.0 | 2,848 | 84.0 | 288 | 8.0 | – | – |
| Maynard, | 3,426 | 1,427 | 41.0 | – | – | 659 | 46.0 | 768 | 54.0 | – | – |
| Medford, | 5,632 | 2,176 | 39.0 | – | – | – | – | 2,176 | 100.0 | – | – |
| Melrose, | 3,070 | 1,472 | 46.0 | 256 | 17.0 | 352 | 24.0 | 864 | 59.0 | – | – |
| Natick, | 28,426 | 2,112 | 7.0 | – | – | 2,112 | 100.0 | – | – | – | – |
| Newton, | 18,331 | 1,562 | 8.0 | 77 | 5.0 | 1,197 | 77.0 | 288 | 18.0 | – | – |
| North Reading, | 8,661 | 4,832 | 56.0 | – | – | – | – | 4,832 | 100.0 | – | – |
| Pepperell, | 14,711 | 5,729 | 39.0 | 640 | 11.0 | 4,596 | 81.0 | 493 | 8.0 | – | – |
| Reading, | 6,306 | 2,017 | 32.0 | 224 | 11.0 | 807 | 40.0 | 986 | 49.0 | – | – |
| Sherborn, | 30,440 | 3,670 | 12.0 | 320 | 10.0 | 1,216 | 32.0 | 2,134 | 58.0 | – | – |
| Shirley, | 14,241 | 3,616 | 25.0 | – | – | 1,139 | 31.0 | 2,477 | 69.0 | – | – |
| Somerville, | 2,634 | – | – | – | – | – | – | – | – | – | – |
| Stoneham, | 4,264 | 2,016 | 47.0 | – | – | – | – | 2,016 | 100.0 | – | – |
| Stow, | 11,478 | 3,328 | 29.0 | 416 | 12.0 | 1,220 | 37.0 | 1,792 | 51.0 | – | – |
| Sudbury, | 15,677 | 6,016 | 38.0 | 1,120 | 18.0 | 1,408 | 24.0 | 3,488 | 58.0 | – | – |
| Tewksbury, | 14,531 | 6,758 | 46.0 | 1,344 | 20.0 | 2,630 | 39.0 | 2,784 | 41.0 | – | – |
| Townsend, | 20,608 | 7,745 | 37.0 | 643 | 9.0 | 1,959 | 21.0 | 5,496 | 61.0 | 622[2] | 9.0 |
| Tyngsborough, | 11,427 | 3,571 | 31.0 | – | – | 915 | 24.0 | 2,656 | 76.0 | – | – |
| Wakefield, | 5,047 | 1,779 | 35.0 | 19 | 1.0 | 192 | 11.0 | 1,024 | 88.0 | – | – |
| Waltham, | 8,650 | 3,727 | 43.0 | 15 | – | 3,712 | 100.0 | – | – | – | – |
| Watertown, | 2,670 | 160 | 6.0 | – | – | 160 | 100.0 | – | – | – | – |
| Wayland, | 10,160 | 1,760 | 17.0 | – | – | 1,440 | 82.0 | 320 | 18.0 | – | – |
| Westford, | 19,838 | 7,053 | 35.0 | 685 | 9.0 | 704 | 10.0 | 5,664 | 71.0 | – | – |
| Weston, | 11,111 | 6,093 | 55.0 | 640 | 10.0 | 1,409 | 22.0 | 4,044 | 68.0 | – | – |
| Wilmington, | 10,959 | 3,917 | 36.0 | 1,248 | 30.0 | 704 | 20.0 | 1,965 | 50.0 | – | – |
| Winchester, | 4,018 | 967 | 24.0 | – | – | – | – | 967 | 100.0 | – | – |
| Woburn, | 8,388 | 2,419 | 28.0 | 166 | 7.0 | 205 | 8.0 | 2,048 | 85.0 | – | – |
| Totals, | 657,831 | 182,662 | 28.0 | 14,050 | 10.0 | 81,077 | 44.0 | 86,819 | 46.0 | 827 | 0.5 |

*Nantucket County.*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nantucket, | 32,221 | 1,164 | 3.6 | 1,100[2] | 95.0 | – | – | 64 | 5.0 | – | – |

[1] Cedar swamp.

[2] Pitch pine.

## *Norfolk County.*

| CITY OR TOWN. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avon, | 2,876 | 1,357 | 47.0 | – | – | 435 | 31.0 | 922 | 69.0 | – | – |
| Bellingham, | 12,073 | 5,952 | 49.0 | 416 | 6.0 | 4,096 | 68.0 | 1,440 | 26.0 | – | – |
| Braintree, | 9,223 | 3,911 | 42.0 | 39 | 1.0 | 2,688 | 67.0 | 1,184 | 32.0 | – | – |
| Brookline, | 4,367 | – | – | – | – | – | – | – | – | – | – |
| Canton, | 12,404 | 6,883 | 56.0 | 352 | 5.0 | 6,051 | 88.0 | 480 | 7.0 | – | – |
| Cohasset, | 6,438 | 3,008 | 46.0 | – | – | 2,336 | 77.0 | 672 | 23.0 | – | – |
| Dedham, | 10,790 | 2,279 | 21.0 | – | – | – | – | 2,279 | 100.0 | – | – |
| Dover, | 15,306 | 5,933 | 39.0 | – | – | 3,213 | 54.0 | 2,720 | 46.0 | – | – |
| Foxborough, | 23,412 | 6,464 | 28.0 | – | – | – | – | 6,464 | 100.0 | – | – |
| Franklin, | 17,282 | 8,604 | 49.0 | 276 | 3.0 | 916 | 10.0 | 7,412 | 87.0 | – | – |
| Holbrook, | 4,687 | 3,200 | 67.0 | – | – | – | – | 3,200 | 100.0 | – | – |
| Hyde Park, | 2,932 | 724 | 24.0 | – | – | – | – | 724 | 100.0 | – | – |
| Medfield, | 9,293 | 2,875 | 31.0 | 692 | 24.0 | 589 | 20.0 | 1,434 | 51.0 | 160[1] | 5.0 |
| Medway, | 7,463 | 3,412 | 45.0 | 64 | 2.0 | 1,856 | 54.0 | 1,492 | 44.0 | – | – |
| Millis, | 7,850 | 3,648 | 46.0 | 51 | 1.0 | 3,136 | 87.0 | 461 | 12.0 | – | – |
| Milton, | 8,448 | 3,853 | 45.0 | 64 | 2.0 | 3,789 | 98.0 | – | – | – | – |
| Needham, | 12,752 | 2,496 | 19.0 | – | – | 2,496 | 100.0 | – | – | – | – |
| Norfolk, | 9,825 | 3,597 | 36.0 | 365 | 10.0 | 704 | 19.0 | 2,528 | 71.0 | – | – |
| Norwood, | 6,780 | 1,376 | 20.0 | – | – | 1,376 | 100.0 | – | – | – | – |
| Plainville, [2] | – | – | – | – | – | – | – | – | – | – | – |
| Quincy, | 10,648 | 3,955 | 37.0 | 32 | 1.0 | 736 | 18.0 | 3,187 | 81.0 | – | – |
| Randolph, | 6,608 | 3,904 | 59.0 | – | – | 896 | 23.0 | 3,008 | 77.0 | – | – |
| Sharon, | 15,557 | 9,728 | 62.0 | – | – | – | – | 9,728 | 100.0 | – | – |
| Stoughton, | 10,492 | 5,664 | 53.0 | – | – | 2,848 | 50.0 | 2,816 | 50.0 | – | – |
| Walpole, | 13,498 | 7,187 | 53.0 | – | – | 2,240 | 31.0 | 4,947 | 69.0 | – | – |
| Wellesley, | 10,514 | 2,496 | 24.0 | – | – | 2,496 | 100.0 | – | – | – | – |
| Westwood, | 11,243 | 3,213 | 29.0 | – | – | – | – | 3,213 | 100.0 | – | – |
| Weymouth, | 11,348 | 4,289 | 38.0 | 20 | – | 288 | 7.0 | 3,872 | 91.0 | 109[1] | 2.0 |
| Wrentham, | 14,516 | 10,918 | 50.0 | 512 | 5.0 | 5,062 | 46.0 | 5,344 | 49.0 | – | – |
| Totals, | 295,975 | 120,916 | 41.0 | 2,883 | 2.0 | 48,247 | 43.0 | 69,527 | 55.0 | 269 | 0.5 |

## *Plymouth County.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Abington, | 6,487 | 4,353 | 67.0 | 32 | 1.0 | 1,920 | 44.0 | 506 | 12.0 | 1,895[3] | 43.0 |
| Bridgewater, | 18,013 | 8,194 | 45.0 | 20 | – | 2,957 | 36.0 | 4,871 | 59.0 | 346[3] | 5.0 |
| Brockton, | 13,745 | 3,914 | 28.0 | 15 | – | 743 | 19.0 | 1,088 | 28.0 | 2,068[3] | 53.0 |
| Carver, | 25,333 | 6,080 | 24.0 | 640 | 11.0 | – | – | 1,376 | 22.0 | 4,064[3] | 67.0 |
| Duxbury, | 15,685 | 9,598 | 61.0 | 128 | 1.0 | – | – | 8,912 | 93.0 | 558[3] | 6.0 |
| East Bridgewater, | 11,339 | 5,018 | 44.0 | 237 | 5.0 | – | – | 4,557 | 91.0 | 224[3] | 4.0 |
| Halifax, | 11,117 | 3,457 | 31.0 | 864 | 25.0 | – | – | 2,117 | 43.0 | 416[1] | 12.0 |
| Hanover, | 10,124 | 7,546 | 74.0 | – | – | – | – | 6,458 | 85.0 | 1,088[3] | 15.0 |
| Hanson, | 10,006 | 7,232 | 72.0 | – | – | – | – | 7,232 | 100.0 | – | – |
| Hingham, | 14,454 | 5,095 | 35.0 | 39 | 1.0 | – | – | 4,704 | 92.0 | 352[3] | 7.0 |
| Hull, | 1,621 | 96 | 6.0 | – | – | – | – | – | – | 96[3] | 100.0 |
| Kingston, | 12,180 | 8,519 | 68.0 | 621 | 7.0 | – | – | 2,746 | 33.0 | 5,152[3] | 60.0 |
| Lakeville, | 23,140 | 3,694 | 16.0 | 525 | 14.0 | 2,004 | 54.0 | 621 | 17.0 | 544[1] | 15.0 |
| Marion, | 9,157 | 3,380 | 36.0 | 768 | 20.0 | – | – | 2,612 | 80.0 | – | – |
| Marshfield, | 18,250 | 8,932 | 49.0 | – | – | – | – | 8,576 | 96.0 | 356[3] | 4.0 |
| Mattapoisett, | 11,314 | 5,504 | 49.0 | 1,760 | 32.0 | – | – | 3,744 | 68.0 | – | – |
| Middleborough, | 82,725 | 18,963 | 23.0 | 1,664 | 9.0 | – | – | 13,107 | 69.0 | 1,907[3]<br>2,285[1] | 10.0<br>12.0 |
| Norwell, | 18,502 | 10,943 | 59.0 | 50 | – | 3,712 | 34.0 | 6,125 | 55.0 | 1,056[3] | 11.0 |
| Pembroke, | 14,887 | 4,038 | 27.0 | 141 | 3.0 | – | – | 3,622 | 90.0 | 275[3] | 7.0 |
| Plymouth, | 117,406 | 27,168 | 23.0 | 130 | – | – | – | 27,038 | 100.0 | – | – |
| Plympton, | 9,721 | 3,213 | 33.0 | 205 | 6.0 | – | – | 3,008 | 94.0 | – | – |
| Rochester, | 23,066 | 9,824 | 42.0 | 3,040 | 31.0 | – | – | 6,784 | 69.0 | – | – |
| Rockland, | 6,471 | 3,776 | 58.0 | – | – | – | – | 1,600 | 42.0 | 2,176[3] | 58.0 |
| Scituate, | 10,927 | 3,712 | 34.0 | – | – | 1,280 | 34.0 | 2,432 | 66.0 | – | – |
| Wareham, | 24,338 | 7,565 | 31.0 | 2,432 | 32.0 | – | – | 3,968 | 52.0 | 1,165[3] | 16.0 |
| West Bridgewater, | 10,882 | 5,088 | 47.0 | 96 | 2.0 | 2,496 | 49.0 | 2,264 | 45.0 | 224[3] | 4.0 |
| Whitman, | 4,473 | 2,035 | 45.0 | 19 | 1.0 | 371 | 19.0 | 141 | 7.0 | 1,504[3] | 73.0 |
| Totals, | 635,363 | 188,937 | 30.0 | 13,426 | 7.0 | 15,483 | 8.0 | 129,340 | 69.0 | 26,695 | 15.0 |

[1] Cedar swamp.

[2] Part of Wrentham. See that town. Area, 7,350 acres.

[3] Scrub growth.

## *Suffolk County.*

| CITY OR TOWN. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Boston, . . . . | 26,026 | 2,571 | 10.0 | – | – | 1,672 | 65.0 | 166 | 4.0 | 413[1]<br>320[2] | 17.0<br>14.0 |
| Chelsea, . . . . | 3,543 | – | – | – | – | – | – | – | – | – | – |
| Revere, . . . . | 4,045 | 117 | 3.0 | 24 | 20.0 | 93 | 80.0 | – | – | – | – |
| Winthrop, . . . | 2,432 | – | – | – | – | – | – | – | – | – | – |
| Totals, . . . | 36,046 | 2,688 | 7.4 | 24 | 5.7 | 1,765 | 65.6 | 166 | 6.0 | 733 | 23.0 |

## *Worcester County.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashburnham, . . . . | 26,624 | 14,375 | 54.0 | 282 | 2.0 | 8,960 | 62.0 | 5,133 | 36.0 | – | – |
| Athol, . . . . | 22,016 | 13,647 | 62.0 | 283 | 2.0 | 6,962 | 51.0 | 5,402 | 47.0 | – | – |
| Auburn, . . . . | 9,050 | 3,719 | 41.0 | 160 | 4.0 | 3,559 | 96.0 | – | – | – | – |
| Barre, . . . . | 29,248 | 13,056 | 45.0 | 384 | 3.0 | – | – | 12,672 | 97.0 | – | – |
| Berlin, . . . . | 8,437 | 1,534 | 18.0 | 135 | 9.0 | 141 | 9.0 | 1,248 | 82.0 | – | – |
| Blackstone, . . . | 10,406 | 5,874 | 56.0 | – | – | 5,202 | 89.0 | 672 | 11.0 | – | – |
| Bolton, . . . . | 12,790 | 2,106 | 16.0 | 288 | 14.0 | 288 | 14.0 | 1,530 | 72.0 | – | – |
| Boylston, . . . . | 12,654 | 6,653 | 53.0 | 374 | 6.0 | 6,279 | 94.0 | – | – | – | – |
| Brookfield, . . . . | 17,728 | 6,183 | 35.0 | 941 | 15.0 | 128 | 2.0 | 5,114 | 83.0 | – | – |
| Charlton, . . . . | 28,132 | 14,900 | 53.0 | 1,194 | 8.0 | 13,166 | 88.0 | 640 | 4.0 | – | – |
| Clinton, . . . . | 4,617 | 514 | 11.0 | – | – | 481 | 94.0 | 33 | 6.0 | – | – |
| Dana, . . . . | 12,544 | 4,078 | 33.0 | – | – | 334 | 8.0 | 3,744 | 83.0 | 450[1] | 9.0 |
| Douglas, . . . . | 24,128 | 16,810 | 70.0 | 576 | 3.0 | 14,067 | 84.0 | 2,176 | 13.0 | – | – |
| Dudley, . . . . | 14,272 | 3,610 | 25.0 | – | – | 2,016 | 56.0 | 1,594 | 44.0 | – | – |
| Fitchburg, . . . . | 18,240 | 3,328 | 18.0 | 800 | 24.0 | 1,696 | 51.0 | 832 | 25.0 | – | – |
| Gardner, . . . . | 14,784 | 4,846 | 33.0 | 992 | 20.0 | 2,650 | 55.0 | 1,204 | 25.0 | – | – |
| Grafton, . . . . | 14,929 | 4,128 | 27.0 | – | – | 4,128 | 100.0 | – | – | – | – |
| Hardwick, . . . . | 25,600 | 8,212 | 32.0 | – | – | 237 | 3.0 | 7,975 | 97.0 | – | – |
| Harvard, . . . . | 17,267 | 3,770 | 22.0 | 160 | 4.0 | 256 | 7.0 | 3,354 | 89.0 | – | – |
| Holden, . . . . | 23,166 | 7,680 | 33.0 | 76 | 1.0 | 7,604 | 99.0 | – | – | – | – |
| Hopedale, . . . . | 3,372 | 1,031 | 31.0 | – | – | 1,031 | 100.0 | – | – | – | – |
| Hubbardston, . . . | 26,692 | 13,012 | 58.0 | 3,469 | 27.0 | 7,719 | 59.0 | 1,824 | 14.0 | – | – |
| Lancaster, . . . . | 18,112 | 6,717 | 37.0 | 384 | 6.0 | 4,367 | 65.0 | 1,966 | 29.0 | – | – |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Leicester, | 15,695 | 11,565 | 74.0 | 480 | 4.0 | 10,573 | 91.0 | 512 | 5.0 | – | – |
| Leominster, | 18,816 | 4,366 | 23.0 | – | – | 3,329 | 24.0 | 1,037 | 76.0 | – | – |
| Lunenburg, | 18,624 | 5,031 | 27.0 | – | – | 2,771 | 55.0 | 2,260 | 45.0 | – | – |
| Mendon, | 11,584 | 5,184 | 45.0 | 64 | 1.0 | 4,992 | 96.0 | 128 | 3.0 | – | – |
| Milford, | 9,600 | 2,887 | 30.0 | – | – | 2,887 | 100.0 | – | – | – | – |
| Millbury, | 10,752 | 2,938 | 27.0 | 45 | 2.0 | 2,893 | 98.0 | – | – | – | – |
| New Braintree, | 13,696 | 2,624 | 19.0 | – | – | – | – | 2,624 | 100.0 | – | – |
| North Brookfield, | 14,208 | 1,811 | 13.0 | – | – | 1,811 | 100.0 | – | – | – | – |
| Northborough, | 11,978 | 3,872 | 32.0 | 141 | 4.0 | 2,547 | 66.0 | 1,184 | 30.0 | – | – |
| Northbridge, | 12,160 | 5,600 | 46.0 | – | – | 1,542 | 28.0 | 4,058 | 72.0 | – | – |
| Oakham, | 13,585 | 3,366 | 25.0 | – | – | – | – | 3,366 | 100.0 | – | – |
| Oxford, | 17,528 | 10,100 | 58.0 | 282 | 3.0 | 9,818 | 97.0 | – | – | – | – |
| Paxton, | 9,855 | 2,467 | 25.0 | 269 | 11.0 | – | – | 2,198 | 89.0 | – | – |
| Petersham, | 24,448 | 9,363 | 31.0 | 1,536 | 16.0 | 4,064 | 43.0 | 3,763 | 39.0 | – | – |
| Phillipston, | 15,424 | 5,415 | 35.0 | 423 | 8.0 | 2,560 | 47.0 | 2,432 | 45.0 | – | – |
| Princeton, | 22,850 | 10,803 | 47.0 | 1,024 | 10.0 | 2,240 | 21.0 | 7,539 | 69.0 | – | – |
| Royalston, | 27,968 | 8,969 | 32.0 | 3,017 | 33.0 | 256 | 3.0 | 5,696 | 64.0 | – | – |
| Rutland, | 23,111 | 6,522 | 28.0 | 147 | 2.0 | 365 | 6.0 | 6,010 | 92.0 | – | – |
| Shrewsbury, | 13,969 | 3,580 | 26.0 | 28 | 1.0 | 3,552 | 99.0 | – | – | – | – |
| Southborough, | 9,865 | 2,010 | 20.0 | 435 | 20.0 | – | – | 1,575 | 80.0 | – | – |
| Southbridge, | 13,312 | 3,981 | 30.0 | 480 | 12.0 | 2,816 | 70.0 | 685 | 18.0 | – | – |
| Spencer, | 21,774 | 6,509 | 29.0 | 2,208 | 33.0 | 4,064 | 64.0 | 237 | 3.0 | – | – |
| Sterling, | 20,032 | 5,432 | 27.0 | 544 | 10.0 | 1,464 | 25.0 | 3,424 | 65.0 | – | – |
| Sturbridge, | 11,520 | 7,443 | 65.0 | 77 | 1.0 | 2,259 | 30.0 | 5,107 | 69.0 | – | – |
| Sutton, | 21,952 | 5,605 | 26.0 | 96 | 2.0 | 5,509 | 98.0 | – | – | – | – |
| Templeton, | 20,800 | 3,475 | 17.0 | 1,152 | 33.0 | 1,632 | 47.0 | 691 | 20.0 | – | – |
| Upton, | 13,312 | 6,067 | 45.0 | 122 | 2.0 | 5,164 | 85.0 | 781 | 13.0 | – | – |
| Uxbridge, | 19,328 | 9,741 | 50.0 | 205 | 2.0 | 9,344 | 96.0 | – | – | 192[3] | 2.0 |
| Warren, | 18,240 | 5,683 | 31.0 | – | – | 3,200 | 56.0 | 2,387 | 42.0 | 96[4] | – |
| Webster, | 9,280 | 3,411 | 37.0 | 83 | 3.0 | 3,328 | 97.0 | – | – | – | – |
| West Boylston, | 8,819 | 3,853 | 44.0 | – | – | 3,360 | 92.0 | 493 | 8.0 | – | – |
| West Brookfield, | 13,504 | 2,234 | 17.0 | 58 | 3.0 | 1,344 | 62.0 | 832 | 35.0 | – | – |
| Westborough, | 14,528 | 4,576 | 31.0 | – | – | 3,360 | 73.0 | 1,216 | 27.0 | – | – |
| Westminster, | 23,872 | 13,332 | 56.0 | 1,069 | 8.0 | 9,415 | 79.0 | 2,848 | 21.0 | – | – |
| Winchendon, | 29,120 | 20,544 | 70.0 | 2,016 | 10.0 | 16,256 | 79.0 | 1,952 | 9.0 | 320[2] | 2.0 |
| Worcester, | 24,643 | 2,637 | 11.0 | – | – | 2,637 | 100.0 | – | – | – | – |
| Totals, | 994,560 | 372,779 | 37.5 | 26,597 | 7.1 | 222,923 | 59.8 | 122,048 | 32.7 | 962 | 0.4 |

---

[1] Scrub growth.

[2] Hemlock growth.

[3] Cedar swamp.

[4] Pitch pine.

*Summary by Counties.*

| COUNTY. | Area (Acres). | Forest Area (Acres). | Per Cent. | Pine Types. | Per Cent. | Hard-wood Types. | Per Cent. | Mixed Types. | Per Cent. | Miscellaneous Types. | Per Cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Barnstable, | 263,273 | 140,135 | 53.0 | 13,270[1] | 9.4 | 6,382 | 4.6 | 95,207 | 68.0 | 29,113[2]<br>32[3] | 18.0 |
| Berkshire, | 630,904 | 330,074 | 54.0 | 14,357 | 4.0 | 150,558 | 47.0 | 140,099 | 42.0 | 24,917[4] | 7.0 |
| Bristol, | 367,642 | 117,193 | 32.0 | 6,149 | 5.0 | 24,024 | 20.0 | 72,583 | 68.0 | 8,735[2]<br>5,690[6] | 5.0<br>2.0 |
| Dukes, | 71,786 | 23,786 | 33.0 | 322[1] | 1.5 | 4,297 | 17.0 | 18,358 | 66.0 | 3,310[2] | 15.5 |
| Essex, | 326,660 | 108,537 | 33.0 | 5,891 | 4.0 | 44,429 | 43.0 | 55,787 | 51.0 | 1,693[5]<br>96[1] | 2.0 |
| Franklin, | 441,560 | 224,850 | 50.0 | 10,273 | 4.0 | 34,085 | 39.0 | 128,385 | 57.0 | 880[1]<br>1,907[5] | – |
| Hampden, | 412,934 | 127,890 | 31.0 | 4,016 | 6.0 | 52,998 | 41.0 | 69,870 | 51.0 | 1,260[4]<br>1,216[1] | 1.0<br>1.0 |
| Hampshire, | 380,032 | 146,997 | 38.0 | 2,213 | 2.0 | 46,998 | 32.0 | 96,706 | 65.0 | 1,018[5] | 1.0 |
| Middlesex, | 657,830 | 182,662 | 28.0 | 14,050 | 10.0 | 81,077 | 44.0 | 86,820 | 46.0 | 205[5]<br>622[1] | – |
| Nantucket, | 32,220 | 1,164 | 3.6 | 1,100[1] | 94.0 | – | – | 64 | 6.0 | – | – |
| Norfolk, | 295,975 | 120,916 | 41.0 | 2,883 | 2.0 | 48,247 | 43.0 | 69,527 | 55.0 | 269[5] | – |
| Plymouth, | 635,363 | 188,937 | 30.0 | 13,426 | 7.0 | 15,483 | 8.0 | 129,340 | 69.0 | 23,450[2]<br>3,245[5] | 14.0<br>2.0 |
| Suffolk, | 36,046 | 2,688 | 7.4 | 24 | 0.9 | 1,765 | 65.6 | 166 | 6.0 | 413[2]<br>320[7] | 22.7[8] |
| Worcester, | 994,560 | 372,780 | 37.0 | 26,597 | 7.0 | 222,923 | 60.0 | 122,048 | 33.0 | 192[5]<br>320[7] | – |
| State, | 5,321,787 | 1,972,950 | 37.7 | 100,015 | 5.1 | 731,594 | 36.9 | 1,084,793 | 52.0 | 29,420[4]<br>11,025[5]<br>16,100[1]<br>65,021[2] | – |
| Total, | – | – | – | – | – | – | – | – | – | 121,566 | 6.0 |

[1] Pitch pine.
[2] Scrub growth.
[3] White pine.
[4] Spruce and hemlock mixed.
[5] Cedar swamp.
[6] Spruce growth.
[7] Hemlock growth.
[8] Miscellaneous.

## Pine Tree Blight.

There has been much concern over a condition of the pine trees during the past season. A small per cent of the white pine trees in every section of the State have been affected with a malady which has caused the tips of the needles to turn brown and die. Trees thus affected were very conspicuous, and during midseason, when it was very dry, they took on a very unhealthy appearance. Some trees were more pronounced than others, depending upon just how far down the needles from the tip the so-called "blight" had spread. All trees, however, even though slightly affected, showed sickly characteristics, in that even the remaining live portions of the tree were lighter in color, and the current season's growth was much impaired. Both large and small trees were equally troubled, but it was quite noticeable that almost invariably those trees showing the naturally weaker vitality in their struggles for existence were the ones affected. Trees that are badly affected are sure to die, as the evergreens cannot withstand defoliation, in this respect differing from deciduous trees.

As soon as the fall rains came, these trees took on a better color, and the reddish tips, so characteristic during the summer, became inconspicuous or dropped off, so that at present the trouble is not so noticeable. Whether this blight will be as bad again next season is problematical. Trees that have been affected the past season will undoubtedly show the effects in retarded growth and vitality next; and, should the trouble reassert itself, it will probably be advisable to utilize them for timber or wood. In the case of small trees which occur here and there it would be advisable to cut and burn them, as a precautionary method.

The following interview, which appeared in the Boston "Transcript," Aug. 20, 1907, gives a very clear statement of our study of the disease: —

There is much speculation throughout the State as to how serious will be this blight. Land owners who see their trees dying are writing to the State Forester on the subject, asking for information and advice; and it is apparent that it is causing deep concern. In some instances it has attacked favorite trees which form important features of ornamental schemes in parks and on private estates, and large sums of money have been offered for treatment that shall save them and cure them. It has been the subject, also, of much scientific study, resulting in conclusions that are somewhat reassuring.

Authorities do not quite agree on the question of time within which it made its appearance in Massachusetts. Some say they have noticed it here for about eight years, while others maintain that its first appearance was three years ago; but they are agreed in the verdict that it is more prevalent this year than in any previous season. Hence the question is raised, Is the disease contagious?

On that particular point State Forester Rane is strongly convinced by his own observations. He has toured certain sections of the State thoroughly in quest of information on that subject, and has studied the woodlands to see what relation one dying tree might have to another. One of his assistants also has made a study in the field, and it is believed that when all the data are pieced together Professor Rane will find it possible to send a reassuring communication on the subject to the land owners.

From all that is at hand to-day, the most logical conclusion is that it is not contagious; and Professor Rane, moreover, ventures to say that it is highly improbable that the disease will spread. It will not be as bad next year as it is now, he thinks. In the first place, he finds blighted pines in the midst of a pine grove, with a few trees practically killed and the others not at all touched by it. A perfectly fresh seedling may be found side by side with a matured tree that is dying, and *vice versa*, showing that the disease does not spread from one tree to another, and has no preferences based on the age of a pine.

If one tree is more susceptible to an attack than another, it is the naturally dry and unhealthy, consumptive-looking pine, that shows every sign of being underfed; and from this the deduction is drawn that the strong tree withstands and the weak one yields, when exposed to soil and weather conditions that may be productive of the disease. While it is most common on the white pine, it sometimes attacks the pitch pine also, but it is not as common as many persons may have been led to believe. The State Forester, after his investigation, ventured the estimate that the number of affected pines in the State constitute only a fraction of one per cent of the pine stand, but as yet there are no figures available to qualify this estimate. There is enough of it to give rise to apprehension for the pine forest interest, which is one of growing importance in Massachusetts.

State Forester Rane assigned one of his assistants, B. C. Noyes, the other day to go to Winchendon, whence came many inquiries about the disease, to study the condition in that vicinity, and Mr. Noyes makes this report on the subject: "The blight is found on the pines of all ages. Beginning at the tip of the needle, it works downward and gradually spreads over the whole tree. Trees of weak vitality are most liable to be affected. The blight is undoubtedly due to the unusually cold spring, followed by excessively hot weather and a period of drought. It has been noticed for several years, but much more so at the present time."

Mr. Charles Bosworth of Winchendon says: "I have noticed the blight for six or eight years, and do not think it serious. This year I noticed it first on one or two trees in the grove in front of my house. These trees are now recovered, while others are affected. In three or four weeks' time I think it will be entirely gone."

Mr. White of Winchendon says: "I have noticed the blight for a long time. One old pine has been in nearly this same condition every year for the past ten years. I do not think it is serious."

Mr. W. H. Brown of Winchendon says: "About two years ago we purchased a tract of growing pine of about six or seven acres. The trees, about a foot high, were at the time pretty generally attacked with the blight, and we hesitated in buying it, on that account. We bought it, however, and to-day it is a thrifty growth, only a few pines being attacked."

Mr. J. G. Folsom, tree warden, says: "I first noticed the blight about six years ago. Just above the village there were several trees affected on both sides of the road. I watched it for two years, and did not notice any increase. The timber on one side was then cut off, but now I cannot find any trace on the trees on the opposite side."

One suggestion as to the cause of it is that some insect has attacked the trees; but in the investigation thus far made nothing has been discovered to substantiate that proposition. There is no sign of animal life on the dead needles, nor have the needles been stung before withering.

Early in the season Professor Rane communicated with Dr. G. E. Stone, at the Hatch Experiment Station, and in a reply to one of the State Forester's letters Dr. Stone writes on the subject as follows: "This trouble has been common since the cold winter of three years ago. I had opportunities to investigate it at that time, and the next year it commenced to show very badly on trees in the form of sun scald, and in the winter in the form of fungi. There were half a dozen fungi found on the pine, but in my estimation all of these were merely the result of the weakened condition of the trees, owing to the severe winter. Dr. Hermann von Schenck and others agree with me.

"My diagnosis of the trouble is as follows: During that cold winter an enormous number of trees were injured, both above and below the ground. I have seen acres of trees, like birches, alders, apple, cherry and a whole host of others, injured at the same time. The pine was injured below as well as above the ground, and I have dug up their roots year after year and found the small ones dead. . . . There was quite a large percentage of the small roots which died, and the dry summer was too hard for them; consequently, the trees suffered from sun scald, and as a result of this and the dying of the tips of the leaves fungi came in after-ward. . . . I have had trees under observation since that winter, and know of a great many which have recovered entirely. I gathered specimens of certain trees for my laboratory which are absolutely recovered. This has occurred in all cases where the tips of the leaves were burned back only slightly, but when the needles were killed outright there was no recovery of course.

"I had a great many opportunities to observe this in trees planted in rows and growing in forests, and there was absolutely no indication of any contagion, showing that the fungus was a purely secondary matter. In the Middlesex Fells I found about a dozen of these trees two years ago, and made a careful examination of them, but they were isolated from one another in all cases.

"I have been in consultation with some of the authorities in Washington in regard to this trouble, since I have had a large number of specimens to examine, and do not think there is any difference in our diagnosis. This trouble is also found in other portions of New England, Connecticut and Vermont, and I believe it has been reported in New Hampshire."

Some spraying for this disease has been done in Massachusetts, though it is not now believed that such treatment is of any great value. The trees may be saved, however, says State Forester Rane, if treated in time with the right kind of fertilizer. In case most of the needles on the tree are destroyed, the tree cannot be saved by any kind of treatment; and the forester's advice to the owners of such tree is that they cut it down before it dies if there is lumber in it worth saving. If it is only slightly touched, it may possibly be revived. Three pounds of nitrate of soda to a good-sized tree, spread over the ground as far as the branches reach, will give it vigor enough to get out of the effects of the disease attack.

This remedy has been practised by H. L. Frost & Co., tree specialists of Boston, with good success for several years.

## EQUIPMENT.

During the past year the State Forester has found it necessary to have some additional equipment for carrying on his work. The principal additions are: two field hand cameras; one surveyor's level; two hypsometers; two aneroid barometers; two right angle finders; a pedometer; a set of book cases and files; and other smaller field implements and drafting room supplies.

## CHANGES IN ASSISTANTS.

The State Forester has been very fortunate in having a corps of efficient assistants throughout the year. The only deplorable fact is that, as is the usual case, as soon as one's assistants demonstrate their value they are sought after.

Mr. J. J. Dearborn, who has been an assistant in demonstrating practical forestry methods over the State, has done his work so well that the Diamond Match Company has engaged him as their forestry expert. Mr. Dearborn's resignation takes effect February 1.

While the State Forester will miss the valuable service of Mr. Dearborn, he nevertheless will be located with headquarters at Athol in this State and continue in a way to serve the State, although through a private enterprise. The success of Mr. Dearborn can be construed in no other way than a compliment to the effective work of this office during the past year.

Mr. B. C. Noyes, who was also connected with the service until recently, has resigned to accept a position with the firm of H. L. Frost & Co. of Boston.

### EXPENDITURES AND RECEIPTS.

In accordance with section 6 of chapter 409 of the Acts of 1904, as amended by the Acts of 1907, chapter 473, section 2, the following statement is given of the expenditures for the year ending November 30: —

| | |
|---|---|
| Salaries of assistants, | $3,189 63 |
| Travelling expenses (not included in co-operative funds), | 935 60 |
| Instruments, | 196 46 |
| Stationery and other office supplies, | 293 08 |
| Printing, | 875 67 |
| Postage, | 283 30 |
| Miscellaneous, | 154 55 |
| Nursery, | 1,081 96 |
| Total, | $7,010 25 |

There was realized from the sale of seedlings already referred to $235.50, which amount has been turned over to the Treasurer and Receiver-General.

In accordance with section 5 of the above-named chapter, the following statement is given of the receipts for travelling and subsistence: —

### *I. For Lectures.*

| | |
|---|---|
| Everett Grange, Everett, | $2 50 |
| West Newbury Grange, West Newbury, | 1 87 |
| State Board of Agriculture, Springfield, | 4 75 |
| Public Lecture, Sterling, | 3 00 |
| Civic Club, Gleasondale, | 1 00 |
| Oakham Farmer's Club, Oakham, | 3 00 |
| Grange, Petersham, | 3 17 |
| Weymouth High School, Weymouth, | 1 00 |
| Pomona Grange, Lowell, | 2 00 |
| State Board of Agriculture, Amesbury, | 3 86 |
| Pomona Grange, Methuen, | 2 30 |
| Hardwick Grange, Hardwick, | 3 00 |
| Middlesex North Agricultural Society, Westford, | 2 56 |
| Melrose Woman's Club, | 3 15 |
| Massachusetts Horticultural Society, Boston, | 1 00 |
| Walpole Grange, Walpole, | 98 |
| East Sandwich Grange, East Sandwich, | 3 00 |
| Middlesex Worcester Pomona Grange, Groton, | 2 50 |
| Worcester Horticultural Society, Worcester, | 4 50 |
| Field and Forest Club, Dorchester, | 96 |
| Whitman Board of Trade, Whitman, | 2 95 |
| North Dana Grange, North Dana, | 3 92 |
| Natural History Club, Bolton, | 1 15 |
| Springfield Botanical Society, Springfield, | 6 50 |
| New England Woman's Club, Boston, | 1 00 |
| Sloyd Manual Training School, Boston, | 50 |
| Newbury Grange, Newbury, | 2 15 |
| State Board of Agriculture, Worcester, | 4 50 |

A list of the visits made, the area of woodland involved and the receipts for expenses are as follows: —

### *II. For Examinations of Woodlands.*

| OWNER OF WOODLAND. | TOWN. | Area of Woodland (Acres). | Expense. |
|---|---|---|---|
| J. R. Ayer, | Richmond, | 100 | –[1] |
| L. L. Baker, | East Templeton, | 70 | $2 90 |
| N. D. Bill, | Springfield, | 400 | 20 00 |
| Brockton & Plymouth Street Railroad, | Pembroke, | 13 | 1 20 |
| Miss C. Codman, | Dedham, | 18 | 80 |
| F. G. Crane, | Dalton, | 1,600–2,000 | 19 70 |
| M. H. Foskett, | Wilmington, | 35 | 50 |
| A. M. Goldsbury, | Warwick, | 50 | 10 30 |
| Rev. John Graham, | Warwick, | 80 | –[1] |

---

[1] No expense.

*II. For Examinations of Woodlands* — Concluded.

| OWNER OF WOODLAND. | Town. | Area of Woodland (Acres). | Expense. |
|---|---|---|---|
| Fiske & Field, | Weston, | 100 | $0 50 |
| A. S. Hayes, | Hopkinton, | 130 | 1 30 |
| Mrs. S. L. Hammond, | Carlisle, | 52 | 50 |
| Rev. N. S. Hoagland, | Warwick, | 30 | –[1] |
| Dr. R. Hogner, | Mansfield, | 66 | 1 00 |
| Rev. C. L. Hutchins, | Concord, | 200–300 | 74 |
| Graham D. Johnson, | Andover, | 10 | 97 |
| F. B. Knapp, | Duxbury, | 30 | 1 50 |
| Mass. State Hospital for Epileptics, | Palmer, | 200–300 | 3 80 |
| Miss A. McKim, | Warwick, | 30 | –[1] |
| Dr. H. W. Nelson, | Marshfield, | 108 | 1 20 |
| Pontoosuc Woolen Company, | Pittsfield, | 143 | 8 70 |
| Rev. F. H. Rudd, | Richmond, | 30–40 | 50 |
| Salem Fraternity, | Rowley, | 15 | 1 20 |
| H. W. Shepard, | Salisbury, | 100 | –[2] |
| J. F. Spaulding, | Tewksbury, | 25 | 50 |
| Rev. E. Sturgis, | Andover, | 28 | 1 80 |
| R. B. Symington, | Chiltonville, | 3,000 | 3 20 |
| F. W. Wise, | Wellfleet, | 1,200 | 14 65 |
| Ellis G. Wood, | Sandwich, | 100 | –[2] |
| Geo. M. Whipple, | Newburyport, | 50 | –[2] |
| Ormstead Bros., | The Fells, | – | –[2] |
| Frost & Co., | Arlington and Malden, | 100 | –[2] |
| School for the Feeble-minded, | Waltham, | 40 | –[2] |
| Morris Gray, | Cambridge, | 10 | –[2] |
| Brockton Water Commission, | Brockton, | 30 | 1 65 |
| Miss Booth, | Springfield, | 10 | –[1] |
| Ames estate, | North Easton, | 100 | –[2] |

[1] No expense. [2] Paid by owner.

## WHAT THE GENERAL COURT IS ASKED TO CONSIDER AT PRESENT.

### *I. Exemption from Taxation on Forest Land.*

At present we have a law in our statutes (Revised Laws, chapter 12, section 6) that is ineffective, as it requires that 2,000 trees must be set on an acre of land to exempt it from taxation, while as a matter of fact 1,210 trees are all that are at present recommended for such purposes. The species of trees for planting are also too small, and the time for exemption I believe could well be extended to twenty years. In Wisconsin similar planting is exempt for thirty years. This law should be amended and modernized to meet our needs.

### *II. Forest Reserves.*

It is time that some State forest reserve policy should be established in Massachusetts. The national government is doing much in this direction, and various States have State forest reserves. I would not recommend that this State go into an elaborate system of reserves, but if the State Forester could be allowed an appropriation for purchasing cheap lands, and be permitted to replant them for demonstrative purposes, the object lesson would be valuable, and the State could not help profiting thereby financially. It is even possible that some towns or individuals would be willing to give lands to the State, provided they could be accepted and planted by the State Forester. One such offer was made during the year, and it is believed offers of land at low cost can be easily secured.

### *III. We must stop Forest Fires.*

After traversing the State and studying conditions carefully, I feel that it will take some drastic mandatory laws in order to cope with the situation. Our people have been so indifferent toward forestry and the protection of forest property that we are absolutely wasting thousands upon thousands of dollars, not only for the present but the future, through sheer negligence. Even much of our so-called scrub growth would yield cord wood, if not lumber, were it not for fires which periodically run over these lands.

With the newly appointed forest warden system better results are expected; but why not clothe this officer with the power to arrest without a warrant any person or persons found in the act of unlawfully setting a fire or trespassing on forest property. This right is given the fish and game wardens; why not the forest wardens and their deputies?

We have a law in our statutes at present (Revised Laws, chapter 32, section 24) which reads as follows: —

> In a town which accepts the provisions of this section or has accepted the corresponding provisions of earlier laws, no fire shall be set in the open air between the first day of April and the first day of October, unless by written permission of a forest warden. The forest warden shall cause public notice to be given of the provisions of this section, and shall enforce the same. Whoever violates the provisions of this section shall be punished by a fine of not more than one hundred dollars, to be divided equally between the complainant and the town, or by imprisonment for not more than one month, or by both such fine and imprisonment.

This law, it is believed, should not be left to the discretion of the towns, but should be enacted as a State law.

### IV. *The Forest Nursery should be enlarged.*

If we had one million white pine seedlings at the State nursery to distribute at cost, I believe they would all be purchased and set out in Massachusetts this coming year. As a matter of fact, we shall not begin to be able to supply the demand, and already I have placed orders for spring delivery for two hundred and fifty thousand white pine seedlings for Massachusetts people. These seedlings can be raised for less than one-half our people are compelled to pay at the present time. As State Forester, I am very anxious to get just as many trees set on our waste and unproductive lands as possible; and, while nurserymen are adjusting their business to meet the growing demands for young trees, and are unable to supply them even at present high prices, it is well that we encourage our forestry interests by growing seedlings at cost. Were it not for the import duty, transplants (seedlings once transplanted) could be imported from Europe, and all charges paid, cheaper than we can purchase the seedlings themselves in this country.

It takes at least two years to grow white pine seedlings before they are ready to be set out permanently, and three or four years for transplants; hence, if we enlarge our nursery work now, it will be some time before the plants are ready for distribution.

Besides white pine, there are many other species of forest trees that should be propagated for dissemination.

I would recommend that the nursery work be increased to at least four times its present capacity. While the first cost would seem large, nevertheless, in from two to four years the money would be returned to the State from the sale of seedlings.

### V. *Increased Appropriation needed.*

While the State Forester deplores the necessity for asking for increased appropriations for his work, he nevertheless feels that it is his duty to do so. While, as has already been shown, the money for both increased nursery work and forest reserves will be returned to the State ultimately, nevertheless, such appropriation must be made to begin with. Five thousand dollars could be used to advantage in enlarging the nursery, and for a system of forest reserves for which the first cost would be relatively large, it is recommended that an appropriation be made.

The regular appropriation for running expenses for the past year was at the rate of $10,000 a year. This amount is asked for the present year.

Beginning with the spring town elections, according to the law passed last year, the new town forest warden law goes into effect. In order to establish the work as it should be, and encourage each town to do more thorough and definite work, a State appropriation of $10,000 is recommended. Of this amount, $2,000 is to be used for holding a convention as stated in the law, and the remainder used in paying forest wardens in various towns for actual service rendered in their respective towns in securing data and rendering services when called upon by the State Forester.

This recommendation applies equally to all towns of the State, as, if it were left to the towns themselves, many would very likely be indifferent; therefore, it is believed it becomes a matter for State legislation. All bills of forest wardens for services rendered at the request of the State Forester must be approved by that office; hence there is good assurance that the money will be strictly used for bettering forestry conditions everywhere in the State. The State Forester even hopes for example, to so educate his wardens that they may be on the lookout and report upon such insects as the gypsy moths should they invade new territory.

Only through forethought and system can we expect to accomplish in forestry what all our citizens would like to see.

### SUMMARY OF RECOMMENDATIONS.

1. That the law relative to the exemption from taxation of lands set to forest trees be amended.
2. That a system of forest reserves for the State be established, and funds for their purchase and maintenance be created.
3. That the State Forester and his authorized employees and the forest wardens and their authorized deputies be given the same power of arresting persons found in the act of unlawfully setting a fire that the fish and game deputies now have.
4. That the law relative to permission to set fires in the open be amended, and made mandatory to the whole State.
5. That the appropriation for the State Forester's office be the same as last year, $10,000, but that an additional $15,000 be

made for the purpose of increasing the State nursery work, holding the convention of forest wardens, and recompensing these men for their assistance in the broader State forestry work as required under direction of the State Forester.

6. That the State Forester's annual report be made a public document.

Respectfully submitted,

F. W. RANE,
*State Forester.*

# BULLETINS

# MASSACHUSETTS BOARD OF AGRICULTURE,

PUBLISHED IN

## MASSACHUSETTS CROP REPORTS, 1907.

# CORN AS A GRAIN CROP IN MASSACHUSETTS.

BY PROF. WM. P. BROOKS, DIRECTOR MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION.

It is the purpose of this article to consider this crop almost exclusively from the standpoint of grain production, though occasional reference to suitability for ensilage has been made.

Indian corn is in many respects the most important crop of the United States. It is produced here in much greater quantity than in all the rest of the world put together. Several times within recent years the total crop has exceeded two and one-half billion bushels. This is at the rate of about 35 bushels for each man, woman and child in the country. The crop finds many uses; but by far the larger portion is employed as stock food, and the manufacture of starch, glucose, whiskey and alcohol consumes in the aggregate enormous quantities. There is not a State nor a Territory in the Union in which corn is not grown, but its cultivation is largely concentrated in the great States of the Mississippi valley. Corn, however, always has been and is now an important crop in Massachusetts. The average product per acre in the United States as a whole during the five years 1901 to 1905 inclusive was about 25 bushels. In Massachusetts the average product during the same period was about 34 bushels; and, while Massachusetts is not generally looked upon as a great corn State, it is significant that it is exceeded in average product by but very few States, and in the value of product per acre by only one, — Connecticut. These facts do not, of course, prove that corn growing is more profitable in Massachusetts than in other States, for the costs of production may be and probably are greater than in the States of the middle west. There can be no doubt, however, that corn can be produced at a profit in Massachusetts, for the average price per bushel is far higher than in most parts of the country. In 1905 the average farm prices of corn were as follows: in the United States as a whole, $0.288; in Iowa, $0.34; in Illinois, $0.38; in Indiana, $0.38; in Massachusetts, $0.70. We must, of course, use fertilizers more largely in Massachusetts than in the States named; but even in these States the soils are gradually becoming less fertile, and the use of fertilizers, in small amounts at least, is becoming general. On many soils in Massachusetts an average expenditure of about $20 per acre for fertilizers will insure an annual product at the rate of from 60 to 70 bushels. This is at the rate of only about $0.30 per bushel for corn produced, but in Massachusetts the stover is worth much more as forage than in the States which have just been named. On many Massachusetts farms the value of the stover will equal the total expenditure for fertilizers, so that the corn produced costs the farmer only the amount expended for labor in the production of the crop. The labor cost in this State is often unnecessarily high. It must perhaps always average somewhat higher than in the great States of the Mississippi valley, for our farms are rougher and our corn fields average smaller. The price of farm lands, however, in this State is so low that obstructions to the use of more progressive methods may be removed, and the total expenditure, including first cost and improvements, will still be lower than the price of good farm land in many of the great States in the corn belt. These improvements being made, the labor cost of producing corn in Massachusetts need not be materially, if at all, greater than in the great corn States. If, then, as can scarcely be doubted, the stover is worth enough in this State to cover the cost of the needed fertilizers, and the labor cost can be kept practically as low as in the great corn States, there would seem to be no reason why Massachusetts should not produce a much larger proportion of the corn used within her borders. It is certain, at least, that our farmers buy too much corn.

## Special Reasons why Corn is a Desirable Crop.

The fact that our soils and climate are admirably suited for the production of corn is among the reasons why the American farmer can produce food at prices which defy competition.

Among the various plants which are cultivated by man, the corn plant is in many respects one of the most wonderful. In a very real sense it is a child of the sun. There are indeed varieties which may be cultivated well to the north, but only in localities where the summer, though short, is fervid. The sun is a source of power, and the plant which thrives best under the intense heat of the sun is the plant which, other things being equal, can store up in its tissues or in its seeds the maximum of energy poured out upon its leaves by the sun. Among the different crops which we can cultivate, none equals corn in its capacity for storing up this heat energy. The chemist in comparing different foods is accustomed to speak of their ultimate food value on the basis of the total amount of heat produced when the food is assimilated and fully oxidized in the body, or burned in apparatus especially designed for the purpose. His unit of measurement is the calorie.[1] On the basis of total heat energy produced, the products per acre of some of the leading crops have the following relative valuations:[2] —

| | Calories. |
|---|---|
| One acre of corn, | 10,020,800 |
| One acre of mangels, | 6,801,760 |
| One acre of Swedes, | 6,268,860 |
| One acre of potatoes, | 6,024,600 |
| One acre of oats, | 3,578,660 |
| One acre of rye, | 3,731,000 |

On the basis of cost per acre on the college farm, 10,000 calories of heat energy cost as follows: with corn as the crop, $0.033; with mangels, $0.112; with Swedes, $0.051; with potatoes, $0.083. Oats and rye are not cultivated on the college farm, and it is impossible to extend the comparison to these crops. It will be noticed that corn far surpasses either of the other crops in the total number of calories produced per acre, while the cost of 10,000 calories is far lower than with either of the other crops.

But, besides excelling other crops in its capacity to store up power received from the sun in the shape of light and heat, and in the cost of a given amount of food, corn surpasses most other crops in other important particulars. It is remarkably free from disease. Seldom is any considerable proportion of the crop destroyed either by disease or by insect enemies, and, while it is considerably affected by season, it is without doubt one of the most certain among the various crops we can cultivate. From every point of view, therefore, it would seem that corn is a crop deserving of greater attention than it receives on the part of Massachusetts farmers.

## Botanical Characteristics.

Indian corn (*Zea mays*) is a native of the American continent, and is believed to have descended from a wild form characterized by the production of numerous very small ears on each of several joints. A form discovered within comparatively recent times, to which the name *Zea canina* was given, is believed by many to be the parent type. It has sometimes been asserted that pod corn, the variety in which each individual kernel is enclosed in a separate husk, is the parent form of our cultivated varieties; but this theory is not now generally accepted. Corn belongs to the great grass family, — the family which includes all the important cereal grains, as well as the field and pasture grasses, sugar cane, sorghum and broom corn. It differs from most grasses in having a solid, pithy stem, which, by the way, is one of the principal reasons why this crop is so much better fitted for preservation in the silo than other grasses.

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[1] A calorie is the quantity of heat necessary to raise the temperature of a kilogram of water one degree Centigrade.

[2] These figures for corn, mangels, Swedes and potatoes are from a paper on "Field Crops" in "Agriculture of Massachusetts" for 1895, and are based upon crops upon the college farm. The figures for oats and rye are calculated on the basis of the average yields of these crops in Massachusetts. The figure for corn includes the entire plant in the form of silage; those for oats and rye include straw as well as grain, assumed to amount to a ton and a half per acre in each case.

The flowers of the corn plant are imperfect, male and female being borne on different parts of the same plant, the former in the tassels, the latter in that portion of the plant produced at one or more joints which develops into the ear. If just before the corn plant comes into tassel the stem be cut above either of the joints between about the third and sixth, an embryo ear will be found. The ovules, arranged in regular rows as the kernels will be later, can be distinctly recognized. Connecting with the top of each of these is one of the fibers which make up the silk which is later pushed up into the air. One of these ovules with its connecting fiber of silk is a single female flower; and, in order that the ovule may develop into a grain of corn, it is essential that at least one grain of pollen shall fall upon the fiber of silk connected with it and germinate there. To fit the silk the better for catching and holding the pollen grains, the tips are somewhat feathery. The yellow dust which falls so abundantly from the tassel is the pollen, and this is freely carried by currents of air and the wind, often to considerable distances. As is well understood, cross-fertilization in nature usually gives better results than self-fertilization, and so nature has so contrived the corn plant that the pollen on any individual is matured and shed before its pistils are receptive. It must therefore be seen that the silk of any particular plant is usually pollinated from other plants; and it is because of this peculiarity of the corn plant, and because the pollen, made up of grains so minute and light, is carried long distances by the wind, that different varieties of corn are likely to mix more or less, although comparatively widely separated. The distance which will be necessary to insure freedom from mixture will vary with the character of the intervening country and with the direction of the prevailing winds during the time when the corn plant is in flower; but to insure even comparative freedom from crossing, a separation of a number of hundred yards at least is essential. The statement has been made that an embryo ear of corn may be found above each of several of the joints of the corn plant. The question will naturally arise, Why do not each of these develop into a perfect ear? Dr. E. L. Sturtevant, as a result of observations and experiments, believed that, by root pruning just before the period when the corn plant comes into flower, he could cause the development of most of these embryo ears; and he certainly obtained some remarkable results by heavy root pruning from plants standing in excessively rich soil. Nothing of any great practical importance, however, has followed as a result of Sturtevant's work in this particular direction; and, indeed, it may be doubted whether in the case of our field corns at least it is desirable that each plant shall as a rule bear more than one ear. If the weight of the grain of a single good ear of corn is taken, and this be multiplied by the number of corn plants ordinarily standing in a well-stocked field, it will be found that a single good ear to a plant will give an enormous yield, varying according to the size of the ears from 125 to 200 or more bushels of shelled grain. Such a yield as this is probably as great as it is wise, with our present knowledge at least, to aim for; and if it can be obtained by the cultivation of such a variety of corn or by cultivation in such a manner as to insure the production of an average of one good ear to each plant, the results must be eminently satisfactory, — more so than if an equal yield be obtained through the cultivation of a variety producing plural but smaller ears.

### Agricultural Classification and Varieties.

The recognized varieties of Indian corn are as follows: *Z. indurata*, flint varieties; *Z. everta*, pop corns; *Z. indentata*, dent varieties; *Z. saccharata*, sweet varieties; *Z. amylacea*, soft or flour corns; *Z. amylacea-saccharata*, soft or starchy sweet corns; *Z. tunicata*, pod corns.

For the purposes of this article we need consider only the flint, dent and sweet varieties. To the flint varieties belong practically all of the old New England varieties of field corn. Most of them are comparatively early, although there is a wide variation. The plants are short as compared with the dent varieties, and have a much greater inclination to produce suckers. Flint varieties of corn are somewhat less fastidious as to soil and climatic conditions than dent varieties; and, although there are now several dent varieties under successful cultivation in New England, it seems to be true that the soils and climate of this section are on the whole better suited to flint varieties than to dent. This seems to be indicated from the fact that dent varieties of corn continuously cultivated in New England gradually lose some of the characteristics of the dent class, and become more and more like the flint type. The idea is quite generally held that corn of our old New England flint varieties has a higher nutritive value than corn of the dent varieties; but neither the investigations of the chemist nor those of the practical feeder lend confirmation to this view. It is doubtless true that home-made meal from flint varieties averages better than meal from dent varieties, but this is principally because our home-grown corns are better ripened and better cured than western grown. If grain is to be fed without grinding, corn of the dent variety appears to be somewhat preferable to flint corn, for the grain is softer and more easily masticated, and therefore likely to be somewhat better digested. The fact that the flint varieties of corn produce more suckers than the dent is possibly the reason why the ears of the flint varieties are generally better filled at the tip than is the case with the dent varieties; for the pollen produced by the tassels of the suckers must be useful in fertilizing the silks at the tips of the ears. The stalk of the flint varieties is in general more slender than that of dent corns, and, if well cured and fed without cutting or shredding, is more palatable; but this peculiarity of the stalk makes it somewhat more difficult to so build the shocks that they will stand securely while curing.

Many of the characteristics of dent varieties of corn have been indicated in what has been said in relation to flint varieties. In the great corn States the varieties of field corn under cultivation all belong to this class. Many varieties grow to enormous height, and are capable, with a sufficiently long season, of giving extremely heavy yields. On the other hand, there are numerous relatively small varieties, which require a comparatively short season, grown in the States of the northern Mississippi valley. Some of these varieties are desirable grain crops in the most favorable localities in Massachusetts, notably in the Connecticut valley; while in most parts of the State dent varieties are preferred for ensilage.

It is not the purpose of this article to go into detail in relation to corn as a garden crop. It seems worth while, however, to refer to the sweet varieties, on account of their possible use as forage crops. Sweet corn furnishes fodder of very superior quality for feeding green, and the medium to large varieties are well worth cultivating for that purpose. Sweet corn has sometimes been used for ensilage, but is not regarded as equally desirable with suitable flint or dent varieties for that purpose, on account of the fact that the resulting silage, under conditions in all other respects similar, contains a larger percentage of acid than does silage from either flint or dent varieties.

### Good Seed of the Utmost Importance.

It is equally as true of varieties of corn as it is of breeds of live stock, that there is a wide variation in different strains or families of the same species or variety. There is well-bred and highly improved Longfellow corn, for example; and if Longfellow corn be the variety selected, it is seed with these characteristics that should be looked for. Not everything, unfortunately, sold under the name Longfellow is well bred and highly improved. It may be Longfellow corn, and still be greatly inferior to the product of a better breeder or grower. Heredity is of as great importance in the vegetable as in the animal world, and only from well-bred, well-grown seed can the best results be expected. The improvement of varieties of corn has received a great deal of attention during the past few years, both in the different experiment stations, especially of the great corn States, and on the part of individual growers. Great improvement has already been effected. A few States have corn breeders' associations, and systems of registration of pedigree seed similar to those for live stock. New England corn growers have for generations used much care in the selection of seed, and the old New England varieties are many of them highly improved. It seems reasonable, however, to expect that, with the fuller knowledge of the present day and with the improved methods which have been put into successful practice in the west, still further improvement can be made. It seems, therefore, highly desirable that New England corn growers should systematically undertake such improvement. The varieties which we have under cultivation can with little doubt be improved in either of two directions, viz., in composition, or in capacity for total yield of grain.

*Improvement in Composition.* — Improvement in composition must be made with reference to the use to which the crop is to be put. Western growers have found it possible within a few generations of seed to materially modify the composition of the grain. Their efforts have been directed toward modification in three distinct directions: (1) to increase the proportion of protein; (2) to increase the proportion of starch; (3) to increase the proportion of oil.

An increase in the proportion of starch or in the proportion of oil is desirable only if the corn is to be put to some special use. For the manufacture of starch, glucose, alcohol or whiskey, the starch is of course the important product, and a relatively starchy grain is most valuable for these purposes. If the production of corn oil is one of the important objects in view, then, of course, an increase in the proportion of this constituent is desirable. Massachusetts is not likely to produce corn for the manufacture of starch, glucose, alcoholic liquors or oil; the grain here will be used either as animal or human food. For this use, an increase in the proportion of protein is desirable. Our farmers at the present time expend a large amount of money annually in the purchase of stock foods rich in protein. If we could increase the proportion of protein in corn by even a few per cent, it would greatly diminish the necessity for such outlay. That such an increase in the amount of protein is possible can hardly be doubted. The proportion of this nutrient in different samples of corn is found to vary between about 7 and 13 or 14 per cent. Some of the western breeders have succeeded in effecting an increase of about 2 per cent in protein within a very few seed generations. To determine definitely the proportion of protein in Indian corn, a chemical analysis is of course necessary; but examination of the kernels affords clear indications as to the composition. If when cut through the middle the kernel shows a relatively small proportion of the white starchy material and a large proportion of the intensely hard, more or less glossy and slightly translucent, material and a large germ, the grain will be rich in protein. It is fortunately true that all the kernels borne upon one cob usually exhibit similar characteristics. It follows, therefore, that, if the examination of a few kernels from different parts of the ear indicates that it excels in the proportion of the constituents just pointed out, it will be rich in protein; and the balance of the kernels of such an ear should, of course, be planted if increase in protein is the object in view.

*Improvement in Yield.* — When improvement in yield is the object, the first step should be to select a good variety. It would be unwise to attempt the improvement of a poor variety. It could be done, but it is unnecessary, for there are already numerous excellent varieties. From such a variety, select a considerable number of ears which approach the ideal type. Western growers advise the very careful selection of 100 ears from the general crop. These ears should then be more critically examined and compared with each other, and about one-half, including only those which appear to be very superior, should be reserved for yet closer examination. The next step should be to shell these specially selected ears and carefully weigh the grain, and, in the light of the facts thus disclosed, still further reduce the number. Western corn breeders usually advise taking 25 ears for the breeding plot. They generally recommend planting two rows of 50 hills each from each ear. If 25 be the number selected, then rows Nos. 1 and 26 should be planted with corn from ear No. 1, rows Nos. 2 and 27 with corn from ear No. 2, and so on. This duplication is practised in order that the danger of making a wrong selection on account of inequalities in the fertility of the soil in different parts of the plot may be reduced to a minimum. It is best to locate such a plot in the midst of a larger field of the same variety, in order to insure thorough pollination. Each of these rows is to be harvested by itself, the grain shelled, and the product of only a few of the ears giving the highest yields reserved for the breeding plot of the next year; and, in order to effect the utmost possible improvement, only the best ears from these best rows should be selected for further work. The balance of the first year's breeding plot may be used for the general crop of the following year. Some breeders advise that in the breeding plot of the second year, including perhaps the product of the four or five best ears of the first selection, the plants descended from all except one of the original ears should be detasseled, in order to make it certain that cross and not close pollination must take place in the majority of ears in the plot. There is much evidence to show that pollination from plants of remote ancestry gives more vigorous and productive seed than pollination from closely related plants. This plan, therefore, of detasseling all except one of the types of the breeding plot, would seem to be wise.

*Methods of Original Selection.* — Whether the object be to select very critically, with the idea of attempting improvement by systematic breeding, or simply the selection of ears to be used for seed for the general crop, three distinct methods may be followed: (1) the selection may be made from the bin; (2) it may be made when husking; (3) it may be made in the field.

Selection in the bin has the advantage that the best may be picked out from a very large number. Selection when husking perhaps will possess the same advantage if the huskers are persons of sufficient intelligence; and it will have the further advantage that the selected ears may be promptly and carefully dried, which, particularly when the seasons are cool and short, is a matter of the utmost importance. Many ears of corn, which if promptly dried would have made excellent seed, have their vitality much impaired if cured with the balance of the crop in the bin. Where the work is done upon a relatively small scale, the old plan of trussing the selected ears and hanging them where there will be the fullest possible circulation of air has much to commend it. If the work is to be done on a larger scale, a special drying room with artificial heat is desirable.

Selection in the field has the great advantage that the character of the plant, as well as the character of the ear, can be noted. If selection be made in the bin, or even while husking, it may very well happen that the ears which seem to be of exceptionally good quality are of that character simply because they had an exceptional opportunity to develop in the field, — perhaps because the plants producing them stood in spots more fertile than the average, perhaps because they had more room for development. Such ears will not necessarily transmit their qualities. From this point of view, it seems much wiser to select in the field, and to take the ears which are best under average field conditions from plants which exhibit the desired characteristics as to height, size of stalk, number and size of ears, etc.

*The Vitality of the Seed.* — The planting of seed which does not germinate satisfactorily is not infrequently the occasion of disappointment and loss. Western producers of seed corn are prepared to furnish unshelled seed corn, every ear of which has been separately tested. This may seem to be a formidable undertaking; but, since the quantity of corn required to plant a given area is relatively small, it is not, after all, a very great amount of trouble. It is necessary only to remove some five or six kernels from different parts of each ear, and to test each lot by itself. There are many relatively easy methods of determining the percentage of germination of seed corn. If the ears are to be tested separately, perhaps one of the easiest methods will be as follows: On a piece of canton flannel of suitable size mark off with a heavy lead pencil squares about two inches on a side. Thoroughly saturate the cloth with water, and then place it in the bottom of a shallow tray of suitable size. The squares and the ears should be correspondingly numbered. It is then an easy matter to determine the germinating quality of the grain from each of the selected ears. After the kernels have been placed in the squares upon the moist canton flannel, they are to be covered by a second piece of the same goods, which also is first thoroughly moistened. If over the whole a pane of glass is then laid, it will probably be unnecessary to supply additional moisture. The corn will germinate most perfectly at temperatures ranging from about 70 to 80 degrees. If corn be tested by this system, it should be the rule to reject all ears in which the selected kernels do not all germinate. If one does not care to take the amount of trouble necessary to carry out this system of testing, it is at least worth while to test a sample of the mixed seed which is to be planted in the field. One of the most convenient methods of doing this is to fill the bowl of a soup plate with sand of medium grade, add water until it stands on the top, then incline the plate and let the surplus water flow out. When it ceases dripping, place say 100 kernels of corn on the sand, press them down very slightly into it, but do not cover them, lay a pane of glass over the top of the plate, and then reverse a second soup plate of the same size as the first over the glass. This is for the purpose of excluding the light, which is unfavorable to germination. Such a germinating apparatus will give satisfactory results in any ordinary living-room. A sample of corn in which more than 5 to 10 per cent of the seeds fail to germinate must be regarded as unsatisfactory.

*Soil Adaptation.* — In seasons in which the temperature is normal or above normal, fairly satisfactory crops of corn can be produced upon soils of almost any type, if not actually wet. Corn is very impatient of imperfect drainage. It does best when the temperature of both soil and air is high, provided the soil, while not being wet or holding stagnant water within a distance less than 4 or 5 feet below the surface, is capable of supplying the needed moisture. While the experience of our farmers amply demonstrates the correctness of the above statement, it is nevertheless true that corn in average seasons is most at home and will give best results upon the warm medium loams. Here the crops will not be so early as on soils of coarser texture whose temperature averages higher, but the crops are likely to be larger, especially in seasons when the rainfall is somewhat deficient during any part of the period of rapid growth.

*Position in the Rotation.* — The necessity for rotating corn is less than in the case of many of our crops. Even when cultivated many years in succession upon the same field, it still as a rule remains exceptionally free from disease or insect enemies, and with fairly liberal applications of manures or fertilizers will still give satisfactory crops. Numerous instances are on record where corn has been grown for twenty or more successive years in the same field, and the crops at the end of the period were equally as good as at the beginning. Notwithstanding these facts, it is not the best farm practice to put corn many years in succession upon the same ground; better economical results can be obtained if it is grown in rotation. On many Massachusetts farms where corn is or should be an important crop, the only other crop occupying any considerable area is hay, — mixed grass and clover. Under these conditions, a very satisfactory rotation is mixed hay for either two or three years, according to the quantity desired, corn to be husked for grain one year and ensilage corn one year. Corn does exceptionally well on a mixed grass and clover sod; and, as has been pointed out in my articles on the hay crop in Massachusetts, seeding to grass and clover in ensilage corn seems to be one of the most satisfactory methods, unless the soils are very deficient in water holding and conducting capacity. The decaying roots and stubble of the clover sod will furnish to the succeeding corn crop a large proportion of the nitrogen needed. Thus, for example, on one of the plots of the experiment station in Amherst, which for fourteen years had received an annual application of fertilizers supplying only phosphoric acid and potash, and without any application of nitrogen throughout the entire period, corn gave a yield at the rate of about 56 bushels of shelled grain per acre, on a freshly turned mixed grass and clover sod.

### Manures and Fertilizers.

On all farms where stock is kept and where the principal crops are mixed hay, corn and potatoes, the corn field is without doubt the best place in which to use the manure. Corn is a rank feeding crop, and capable of utilizing to great advantage elements of fertility supplied early in the season in relatively unavailable forms, such as are found in farm manures. The principal reason why corn, better than either mixed grass and clover or potatoes, will utilize the elements of value in manures, is because its principal growth is made so much later in the season. Previous to the time when it makes heavy demands upon the soil, the elements which are unavailable at the time of application of the manure will have been rendered available through the action of natural agencies. Every farmer of experience knows that splendid corn crops can be raised upon manure alone; and every such farmer knows also that on seeding after the cultivation of corn on heavy applications of manure fine crops of timothy hay can be produced. Under some circumstances, the use of manure alone, then, in raising the corn crop may prove entirely satisfactory; but it is the belief of the writer that, under the average conditions existing upon the dairy farm at least, there is a better way than to depend upon manure alone. Especially is this true if the hay produced upon the farm is all fed to the farm stock. If the hay is to be fed out on the farm, it is highly desirable that it contain a liberal admixture of clover. If corn crops are raised on heavy applications of manure alone, clover is not likely to do so well when the land is seeded as it will in those cases where the application of manure is more moderate, and is supplemented by small quantities of something supplying phosphoric acid and potash. This fact has been pointed out and the subject discussed at some length in the writer's articles on the hay crop and on clovers,[1] and it seems unnecessary to present facts and figures here to establish the point. It will be useful, however, to point out the difference in results produced upon one of the fields of the experiment station at

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[1] Agriculture of Massachusetts, 1904, 1905 and 1906.

Amherst under the two systems of fertilization. This field was laid out for the purpose of this experiment in 1891, and since that time it has produced ten corn crops and six hay crops. To one-half the field, which includes an acre of land, manure has been applied annually at the rate of 6 cords per acre throughout the entire period, with the following exceptions: it was left without manure in the years 1897, 1902 and 1905, and in 1898 the rate of application was 4 cords per acre. These were years during which the field was in mixed grass and clover, and all or a portion of the usual application of manure was omitted, as experience indicated that the crops would lodge badly should it be applied. On the other half of this field manure was applied at the rate of 3 cords per acre in 1891 and 1892, and during the balance of the time, with the exceptions noted below, at the rate of 4 cords per acre. No manure whatever was applied in 1897, 1902 and 1905, and in 1898 the rate of application was at the rate of 2 cords per acre. In connection with the smaller quantities of manure used on this part of the field, an annual application at the rate of 160 pounds per acre of high-grade sulfate of potash has been made, except in the years when no manure was applied. In these years the potash also was withheld. We have in this field, then, an excellent opportunity to compare the results of the two systems of corn raising, and the averages to date are as follows: —

On the large application of manure alone, the average rates of yield per acre have been: shelled corn, 61.8 bushels; stover, 4,611 pounds.

On the smaller application of manure, combined with the potash salt, similar averages have been: shelled corn, 58 bushels; stover, 4,342 pounds.

It will be noted that the yield on the larger application of manure alone has been at the rate of 3.8 bushels of grain and a little over 250 pounds of stover greater than on the smaller application of manure with potash. The hay crops have been slightly larger on that part of the field receiving the larger application of manure alone, the average difference amounting to about 400 pounds in the first crop and a little less than 300 pounds in the rowen crop. There has been considerable difference in the feeding value of the hay produced under the two systems of manuring. That produced on that portion of the land receiving the lesser quantity of manure and potash has always contained a materially larger proportion of clover, and must therefore have had a higher nutritive value. On this point we have no definite data. It is customary, in estimating the cost of crops, to figure manure as costing about $5 per cord applied to the field. On this basis, and charging the potash salt used at cost, the money difference in the cost of the materials applied to the two parts of this field has amounted to about $6.50 per acre annually. The crops produced on the larger application of manure do not exceed those produced on the smaller application with potash by a sufficient quantity to cover this excess in cost. It is the writer's belief, based upon further experience with other fields, that the products on that part of this field receiving the lesser amount of manure and potash would have been materially increased by the annual or at least occasional application of basic slag meal, which would supply both phosphoric acid and a considerable excess of lime, which would have proved of value in maintaining the soil in that sweet condition which is essential for the best results with the clover crop. It is the writer's conviction, therefore, based upon extended experience, that it will prove the wiser policy on most farms to use manure in raising the corn crop in rather moderate amounts, supplementing it as above indicated by annual applications of basic slag meal and a potash salt. It seems probable that manure at the rate of about 4 cords, slag meal at the rate of 300 or 400 pounds, and high-grade sulfate of potash at the rate of about 125 to 150 pounds, will give results highly satisfactory both in the product of corn and in the product of hay rich in clover on seeding.

That corn can be profitably produced on fertilizers alone is fortunately thoroughly established by experiments in progress in the experiment station. A field containing an acre of land was laid out for an experiment in raising corn on fertilizers in 1891. Since that date ten corn crops have been produced on one half of the field and eight upon the other. The land has been seeded three times, and each time has remained in mixed grass and clover two years. Two combinations of fertilizers have been under comparison: one of these has given an average yield of 56 bushels of shelled grain and 4,484 pounds of stover per acre; the other, 52½ bushels of shelled grain and 4,615 pounds of stover per acre. The hay crops have averaged on the first system of manuring 3,557 pounds per acre for the first crop and 993 pounds for the second. Under the other system of manuring, the average yields have been 3,696 pounds for the first crop and 1,152 for the second crop. It will be seen, therefore, that the fertilizer combination which gave the larger corn crop proved inferior to the other for the production of hay. The principal differences between the two systems are as follows: the first combination of fertilizer materials furnished materially less potash and more phosphoric acid and slightly less nitrogen than the second. The second combination was made very rich in potash and light in phosphoric acid. The superiority of the combination richer in potash for the hay crop is without doubt connected with the fact that the supply of potash was so much more liberal. The writer believes, in the light of his extensive experience, that the amount of phosphoric acid in the second combination might with distinct advantage have been increased. It has been noticed especially that the corn crop starts very slowly on the combination of fertilizers containing so small an amount of phosphoric acid. It is now very generally understood that a rather free use of highly available phosphates goes a long way in insuring the rapid progress of the crop. It is the writer's belief that the proportion of phosphoric acid usually found in special corn fertilizers is needlessly high, and that the proportion of potash in such fertilizers is often much too low. He is equally convinced that somewhat more phosphoric acid than he formerly believed to be essential will prove useful. In the comparisons in question, phosphoric acid is contained in the fertilizers used under the first system at the rate of 180 pounds per acre, actual potash at the rate of 77 pounds; in the second combination (richer in potash), phosphoric acid was applied at the rate of only 50 pounds per acre, actual potash at the rate of 125 pounds. The writer is now inclined to believe that an increase in the amount of phosphoric acid to a total of about 100 pounds per acre would prove useful. This he believes may wisely be supplied in the form of basic slag meal. The best source of potash, in the writer's opinion, is the high-grade or low-grade sulfate. It is true the muriate might give an equally good crop of corn, but on many soils and in many seasons at least, the clover in the succeeding hay crop will make a less satisfactory showing than where one of the sulfates is used. He is inclined to recommend, therefore, a fertilizer application for corn at the following rates per acre: —

| | Pounds. |
|---|---|
| Nitrate of soda, | 100 |
| Sulfate of ammonia, | 100 |
| Tankage, or dry ground fish, | 200 |
| Basic slag meal, | 500 |
| High-grade sulfate of potash, | 200 to 250 |

In the experiments to which reference has been made, the manure employed has always been spread after plowing, and deeply worked in by the use of the disc harrow. Fertilizers have in all cases been applied broadcast after plowing, and harrowed in; and, wherever the soil is in a fair condition of fertility, it is the writer's belief that these methods of application are likely to prove most satisfactory. Hill or drill application of fertilizers may, on the other hand, prove desirable if the fertility of the field is relatively low.

There is, of course, a possible question whether such results as have been obtained in the fields referred to in Amherst will be obtained under a similar system of using manures and fertilizers in other parts of the State; but the experiments of the writer with corn in different parts of the State tend to show that, while the rather liberal use of potash salts which has been recommended may not prove in all cases equally beneficial in other localities as in Amherst, they will nevertheless in the majority of instances prove distinctly beneficial. Of the three fertilizer elements, potash, nitrogen and phosphoric acid, potash on the average in the experiments in different parts of the State has increased the corn crop much more than either of the other elements. In a series of experiments conducted in 1890, thirteen fertilizer experiments with corn were carried out in different parts of the State, one each in the counties of Essex, Middlesex, Plymouth, Bristol, Barnstable, Worcester, Hampshire, Hampden, Franklin and Berkshire. The average increases in crops caused by the several fertilizer elements were at the following rates per acre: —

| | Shelled Grain (Bushels). | Stover (Pounds). |
|---|---|---|
| For potash, | 11.3 | 1,308 |
| For nitrogen, | 4.7 | 389 |
| For phosphoric acid, | 3.6 | 162 |

On one farm in Hadley, on the alluvial soil of the Connecticut valley, the potash gave an average increase at the rate of 48 bushels of shelled grain per acre, nitrogen at the rate of 10 bushels, phosphoric acid at the rate of 1.3 bushels. On a farm in Essex County, upon soil under a sufficiently high state of cultivation to produce an average crop at the rate of about 65 bushels per acre without manure or fertilizer of any kind, an application of muriate of potash at the rate of 160 pounds per acre gave an increase in the crop amounting to about 15 bushels; nitrate of soda at the rate of 160 pounds increased the crop at the average rate of only 4.7 bushels; phosphoric acid at the rate of only 1.4 bushels. In the light of these facts, it is believed that the farmers of the State in raising corn will find it distinctly to their advantage to see to it that the fertilizers used contain more potash than is common in commercial corn fertilizers. The advantages of this practice will show not only in the corn crop, but in the far better clover crops which will follow.

### Planting the Crop.

One of the first things to be thought of in preparing to plant the corn crop is the preparation of the seed. Seed corn, as is generally understood, keeps far more safely on the cob than shelled. It is not best to shell long before the seed is to be used, although this, of course, may be done provided the ears have been very thoroughly dried. The common practice of shelling off and rejecting the grain both at the tip and butt of the ear is to be strongly recommended. The kernels of these portions of the ear are often abnormal in shape and in size. If they germinate, they are likely to produce more feeble plants than the normal full-sized kernels of the other parts of the ear. Moreover, if the corn is to be planted by machine and in hills, it is a very great advantage to have the kernels of substantially even size and shape, for then the machine can be adjusted to drop precisely the required number, — for example, four kernels to the hill; and well-made machines will do this in about 95 out of 100 hills, and in the balance of the hills there will be only a very small variation. If, on the other hand, the grain from the tips and butts is included, the number of kernels dropped per hill will be quite uneven. Special treatment of seed grain with a view to protecting it either from insects or the ravages of the crows and other birds is sometimes adopted, but is not to be recommended if it can be avoided, for germination is better without. If something must be done to protect from crows, the best method seems to be first to soak the corn in hot water, then to allow it to drain off, and while it is still warm and moist stir in a very small quantity of tar. The amount used should be sufficient only to coat each kernel with an extremely thin film. Plaster or air-slaked lime should then be added in sufficient quantity to dry the grain. Any excess of lime or plaster can be sifted out. If the work is properly done, this treatment interferes but little either with planting or with the germination of the seed. Numerous experiments have been tried to determine whether hill or drill planting will give more satisfactory yields. Provided the total number of plants on a given area is substantially even, no great differences in product have been noted. On our New England fields, which are often comparatively rough, it is difficult to plant satisfactorily with a machine in hills; but there are a number of good machines which do excellent work in drill planting, which in the writer's judgment is likely on the whole to be most satisfactory. The distance between plants in rows and the number of plants in a hill must vary with the variety. For the ordinary types of field corn suited to the climate of New England, hills about 3½ feet apart in each direction and with three to four plants in a hill, or drills 3½ feet apart with plants standing on the average about 10 inches apart in the drill will generally be found satisfactory distances. As is generally understood, nothing is gained in planting corn exceptionally early. The Indian rule, to plant when the leaves of the oak are as large as the ears of a squirrel, seems to be as good a rule as any.

## Tillage.

This article has already reached such length that any extended discussion of methods of tillage would carry it beyond the assigned limits. Modern methods of tillage are, however, in general pretty well understood. It is recognized that the policy should be to prevent weeds from growing, not to destroy weeds; that it is highly important to maintain a surface mulch of fine, mellow earth (dust mulch, as it is often called). Accordingly, the smoothing harrow is not infrequently used in the corn field, sometimes before the grain is up. Later, and until the grain reaches a height of several inches, weeders are employed; and when the corn becomes so large that the use of these would seriously injure it, cultivators are set to work. It is now generally recognized that shallow-working cultivators which do not ridge the earth are preferable to any other form. Level culture will ordinarily give better results than hill culture, and when corn is grown in large fields, a riding or sulky cultivator working in two rows at a time is the most desirable form of implement. Little or no hand hoeing should be required.

### Harvesting the Crop.

If one grows corn as a field crop for husking only, and upon the scale usual on New England farms, it may be doubted whether it will pay to purchase a corn harvester; but where ensilage as well as field corn is grown, a self-binding harvester, which is a necessity in handling ensilage corn, may be used with advantage in harvesting the field crop; for the bundles as bound and left upon the ground by the harvester can be readily set up into shocks, which stand more securely than shocks of unbound corn. Corn so put up can be husked without unbinding, so that the stover can be conveniently handled in bundles. In cases where a machine is not available, a corn knife and horse for shocking furnish the needed equipment. A rope with a hook in one end for drawing the tops of the shocks firmly together is of great assistance in so setting them up that they will stand securely through the autumn storms. Binder twine furnishes satisfactory material for binding the tops of the shocks.

In some parts of the State it is still the practice to cut the stalks just above the ears as soon as the latter are beginning to glaze. Under this system, the food value of the part of the stalks cut is likely to be greater than if the whole plant be allowed to stand until the corn is ready to shock, as in the more modern method. If the practice of top stalking be followed, however, the food value of the part of the stalk below the ears is seriously reduced, as the result of long exposure to the autumn storms. The total amount of labor, moreover, is greater in this system than in the system of cutting and shocking, and there can be no doubt that the latter system should usually be followed. Under this system, flint varieties should be cut as soon as they are fully glazed. Dent varieties should be cut when the dent is well defined in the ends of the kernels. Considerable ingenuity has been exercised in the effort to produce a satisfactory husking machine. A number of machines are manufactured which will do the work; but the general consensus of opinion among those who have tried machines for husking is that the economical advantage is at best doubtful, and the greater part of the enormous corn crops of this country is still annually husked by hand. Corn stover in some seasons and with some varieties is sufficiently well cured to keep satisfactorily if stored in mows under cover; but in the writer's judgment it will usually keep more satisfactorily in stacks of moderate size in the open air. It is sometimes hauled to the barn late in the fall or early winter, and run through an ensilage cutter or a shredding machine and then packed in a mow, or in a silo if available. Such cut or shredded stover will not keep satisfactorily in a silo unless it is considerably moistened as it goes in, in order to facilitate better packing; and unless it is especially well cured, it is hardly likely to keep well in large bulk in the mow. It seems to the writer preferable under most circumstances to take the stover from the stacks in relatively small amounts, cutting or shredding at one time only a sufficient quantity to last a week or two. This plan, of course, cannot be conveniently followed unless the farmer owns his own machine and power. Shredded stover, if satisfactorily kept, is much more palatable than that which is simply cut. It will be consumed with far less waste than stover which is fed without special preparation.

# PLUM CULTURE IN MASSACHUSETTS.

BY PROF. F. A. WAUGH, PROFESSOR OF HORTICULTURE, MASSACHUSETTS AGRICULTURAL COLLEGE.

Next to the peach, the plum is the most important stone fruit grown anywhere in the temperate regions. In many localities it is even more important than the peach. This observation holds true in Massachusetts, for while in some sections the peach is a valuable fruit and even an important commercial crop, there are other sections where it cannot be grown. Plums of some sort can be grown, however, in every town in the State.

This much wider adaptability of the plum is due to two causes: first, there are many different varieties, derived from very different species, some of which thrive on one soil and some on another, so that plums may be selected for every kind of tillable soil; second, these different species vary a great deal as regards hardiness. While some of them are more tender than peaches, others are even hardier than apples, so that they may be grown in cold districts and exposed situations. In spite of all its good points, the plum is sadly neglected; in fact, it is a rarity to find an adequate supply of good plums on any farm in Massachusetts. There are a few trees on almost every farm, but the sad fact is that a majority of them are mere breeding places for black-knot; only a few ever bear fine, sound, clean fruit.

Yet the plum is one of the most luscious fruits when properly grown and well ripened on the tree. For eating out of hand it is surpassed by the peach alone; as a dessert fruit it has no superior; while for canning it easily ranks next to the peach, and for jelly making competes for first place with the red currant.

Unfortunately, the general impression has grown up that the plum is a difficult fruit to grow. In a certain sense this is so; but when looked at fairly, the plum is found to be as easily managed as any other crop. The difficulty is that men have considered it to be of secondary importance, and therefore have not given the same careful attention to it that they have to what they consider more important crops. The plum is really no more difficult to grow than corn, tobacco or strawberries. There are a few principles which have to be understood, and a few details which have to be carefully attended to; but these requirements have to be met with every crop, in order to make it a success.

### Soils.

It has already been suggested above that the plum may be grown on a variety of soils; indeed, plums of some sort may be grown on any soil which will produce any kind of agricultural crop. The Japanese varieties, though short lived on sand, will thrive for a few years and give excellent crops on even the lightest soils. The old-fashioned Domestica varieties will do well on heavy clay. Some varieties will even do well on wet land, though for other reasons it is not practicable to plant plum orchards in swamp ground. It should be observed that on heavy clay soils the old-fashioned European plums and Damsons should be planted in preference to other varieties. On good gravelly apple soils almost all kinds of plums can be grown with success. On light sandy soils the Japanese varieties should be preferred; and they may be further adapted to these conditions by propagating them on peach roots.

This matter of propagation is very important in securing the greatest success with plums, but not much can be said or done about it until the nurserymen are in a position to supply plum trees propagated on various kinds of roots.

### Starting the Plantation.

In buying Japanese plum trees from the nursery, one-year-old trees should always be selected; two-year-old trees are much harder to manage. On the other hand, in buying European plums or Damsons, two-year-old trees are to be preferred. This difference is quite important in both cases.

In preparing plum trees for planting, it is the best practice to cut them back rather severely. All long, straggling roots may be removed, being cut back within six or eight inches of the main stem. All side branches should be cut off from the top, and the main stem shortened in to a length not exceeding two feet. In many cases trees may be headed still lower to advantage. Trees closely pruned in this manner are easier to handle and to plant, and they make a better growth the first year and form more symmetrical heads.

In setting a block of plum trees, they may be placed from 10 to 15 feet apart each way. A distance of 10 by 10 feet is enough for smaller-growing varieties, like Damsons and Italian Prune, especially if they are to be kept closely headed in. A distance of 15 by 15 feet each way may be required of vigorous-growing varieties on strong land. The popular Japanese variety Burbank, which inclines to spread horizontally, requires as much space as any. If this variety is properly shortened in each year, it may be comfortably grown, cultivated and sprayed where planted 15 feet apart each way.

Where no highly developed system of management is attempted, the plum tree may be pruned essentially the same as the apple tree. This refers to ordinary farm methods. The center of the tree is kept reasonably well opened, in order to let in light and air; broken branches are cut out as required, and wounds are painted over. This sort of pruning is usually done early in the spring, — the earlier the better; the latter half of March is usually the most convenient time. As a rule, it may be considered better to do this sort of pruning during the month of June; and the transfer of the pruning season from March to midsummer is to be recommended under most circumstances.

Where plums are extensively cultivated for market, so that more critical care is given to them, a more exact system of pruning is to be recommended. Many plum growers adopt the system of heading in their trees annually. This heading in is practised especially at the top of the tree, where strong growth is apt to be made. Most varieties of plums will thrive better under a system of severe cutting back than apple trees will. Under such a system of pruning, branches of a considerable size have to be removed from the interior of the tree from time to time, in order to prevent choking the head. In all these operations it may be borne in mind that the plum tree is naturally shorter lived than the apple (especially the Japanese plum), and the fruit grower is giving himself unnecessary worry when he endeavors to transmit his plum orchard unimpaired to his grandchildren.

### CULTIVATION.

Plum trees require cultivation. Of course they live for a while when growing in grass, but it is very seldom that they will produce even reasonably good crops under such treatment. The system of cultivation to be followed is that now commonly practised by successful apple growers. It consists in plowing the soil early in the spring, or cutting it up with a spading harrow, following this with frequent surface cultivations, using such tools as the spring-tooth harrow, Acme or smoothing harrow, ceasing cultivation about July 1, and planting some sort of cover crop. The cover crop may be omitted in some cases, but is worth while, on account of the fertility which it adds to the soil.

A substitute for cultivation of plum trees which is often advised and used is to plant the trees in a poultry yard. This is recommended on the theory that the poultry will eat up the curculios; but the real advantages come in the partial cultivation of the soil by the scratching poultry, in the elimination of weeds, and in the supply of plant food from the poultry droppings. Certainly plum trees are about the best things that can be found for growing in the poultry yard.

### FERTILIZATION.

The plum bears heavily under reasonably favorable circumstances, and these heavy crops are a serious drain on the vitality of the tree. This fact naturally suggests that the tree should have liberal fertilization. Chemical analysis shows that the plum pits contain unusually large quantities of potash, which ought to be replaced in suitable manures. It is hardly practicable to give a special formula for fertilizing plum trees; they have practically the same requirement as peach trees. As a rule it may be said that lime and potash are especially required, and that one must use his own judgment in the supply of nitrogen, basing that judgment on the color of the foliage and the general vigor of the tree. Dr. Van Slyke recommends the following formula: —

| | Pounds. |
|---|---|
| Nitrate of soda, | 25 |
| Dried blood, | 60 |
| Acid phosphate, | 250 |
| Muriate of potash, | 90 |

This fertilizer has the following composition: nitrogen, 2.4 per cent, total phosphoric acid, 9 per cent; potash, 10.5 per cent.

Barnyard manure well rotted can of course be used on plum trees in small quantities, though it is certain to have an excess of nitrogen and to be weak in potash.

### VARIETIES.

There are a great many different kinds of plums on the market, and the problem of selecting those which are best suited to particular soils and special requirements is a rather difficult one. Much of the failure which we see is due to the selection of unsuitable varieties, and many men are discouraged by such results.

The old-fashioned garden plums, which came to our country from Europe, are probably the best known; and where they can be successfully grown they are the most desirable. There are some drawbacks with these varieties, even under the best conditions. For instance, they are slow about coming into bearing, and they are very susceptible to the attacks of black-knot. Those varieties of this class which are most generally successful in Massachusetts are Bradshaw, Lombard, Italian Prune, Englebert, Quackenboss and Grand Duke. There are some other favorite varieties, which, though more difficult to grow, should not be forgotten. Probably the Green Gage stands first amongst these, though in most cases Bavay (Reine Claude) is to be preferred to the genuine Green Gage, it being a later, larger and better edition of the same variety. Another fine old-fashioned plum which is comparatively difficult to grow is the Yellow Egg or Magnum Bonum. Coe's Golden Drop falls into this same category. The different kinds of Damsons have somewhat the same characters as the European garden plums just mentioned, though the trees are rather smaller and usually come into bearing earlier. The Damson plums find a very ready market in New England cities, and where they can be well grown are amongst the most profitable of all.

The Japanese plums have played an almost revolutionary role in this branch of fruit growing; they now undoubtedly form a majority of all the plum trees growing in the State. Of these, the Burbank is the most widely useful. It seems to succeed everywhere, and is a satisfactory plum for both home use and market. Satsuma, much prized for canning, succeeds admirably in some places and fails utterly in others. It is not so hardy as Burbank. Red June, though of poor quality, is early and prolific. These two qualities make it a successful variety, and one of the most profitable for market. Abundance has the best quality of any of the Japanese plums commonly grown, and by many is regarded as the most satisfactory one for garden culture. The tree is short lived, however, and subject to disease, so that the variety could not be recommended for market gardening. Chabot is one of the best late-ripening varieties.

There are several hybrid plums of more or less consequence, — chiefly less. The one most widely planted is Wickson. In some places this has given promise of being a useful commercial variety, but on the whole it cannot be recommended. Other varieties of partial American parentage, such as Gold, Waugh, Gonzales, etc., have been tested to some extent, but do not appear to be well adapted to conditions in Massachusetts.

## POLLINATION.

One striking quality of the plum tree is its demand for cross-pollination. There are very few varieties which will bear fruit of themselves; nearly all require to have their blossoms fertilized by pollen from other trees. This tendency is so striking in most varieties that they will bear no fruit at all without cross-pollination, and practically all varieties bear more fruit and of better quality when properly cross-pollinized. In order to secure this cross-fertilization, it is necessary to have two or more varieties growing near each other. Where the trees are planted in gardens, it is best to have these different varieties in alternating rows. Where large blocks are being planted for commercial orchards, not more than three or four rows of a single variety should be placed together. It is important to observe that varieties which are placed together for purposes of cross-pollination should blossom at the same time.

## DISEASES.

The black-knot has long been the bugaboo of the farmer or householder who wishes to grow a few plums. Neglected trees are frequently, or even usually, killed by this disease, and many persons suppose it to be necessarily fatal to all kinds of plums. This is far from the truth, however. Japanese plums are much less severely attacked by black-knot than the ordinary varieties, but they are not immune. Plum trees, even of the most susceptible varieties, which receive good care will rarely suffer from black-knot. Spraying will do something to check the disease, but the pruning knife will do more. Every black-knot should be cut out and burned as soon as it is seen. If a general pruning is given the trees in June, most of the black-knot will be discovered in its earliest stages; then is the best time for its removal. The fruit grower should go through the plantation again during the period when the leaves are off, when any fully developed knots are more plainly visible; these should then be removed and burned. If this practice is kept up year after year, there will be no difficulty whatever.

Another disease which is very embarrassing to the plum grower at times is the brown rot or ripe rot, most conspicuously seen on the fruit just at ripening time. This often ruins a large proportion of the crop. It is caused by a fungus which grows in the twigs and fruit throughout the summer season, but which manifests itself most conspicuously on the fruit at ripening time. Considerable check will be given to this disease also by properly spraying with Bordeaux mixture. Careful hand-thinning of the fruit will do more toward checking the disease. Many varieties of plums, especially the Japanese, may be picked some days before they are dead ripe, and this offers another means of getting ahead of the brown rot.

### Insects.

As the black-knot is considered to be a universal and fatal disease, so the curculio is commonly considered to be an insect ruinous to the plum grower's interest. It is true, of course, that in many cases a large part of the crop is injured by this insect, and sometimes practically the entire crop is damaged. This seldom or never occurs, however, in large blocks of plum trees, or on trees which are cultivated or grown in poultry yards. In fact, in our experience the curculio is a distinct blessing. The fruits are usually punctured early in the season, when they are about the size of peas. Punctured fruits commonly fall off early in the season, and the curculio thus becomes an efficient assistant in thinning the fruit. This practice of thinning out the fruit on plum trees is very important, and should be attended to every year about the last of June. After the curculio has taken off from 10 to 80 per cent of the crop, it is usually necessary to pick another large amount by hand; the curculio thus saves much expensive hand labor. It is not the purpose of this article to praise the curculio, nor to recommend its adoption as a universal field assistant in plum growing, but simply to point out that it is not a serious menace to the business.

The San José scale is by all means the most important insect which we have to deal with in plum growing. It is very fond of plum trees, especially those of the Japanese varieties. On these it multiplies rapidly, and trees once attacked are very soon ruined. Extensive experiments made at the Massachusetts Agricultural College and elsewhere show that this insect may be held in check by proper applications of lime-sulphur spray. Experience generally indicates that this is the best treatment.

### SPRAYING.

Plum trees need some spraying, usually on about the same lines as the work given to the apple orchard. Spraying should be given annually, usually two to four times each year, and in all cases must be thorough to be worth while. Careless spraying is a waste of time and material. When the San José scale is to be treated, the lime-sulphur spray will be given early in the spring. A heavy spraying of Bordeaux mixture or of plain blue vitriol solution before the buds open will aid in checking brown rot and other diseases. Another spraying of Bordeaux mixture, with arsenical poison added, should be given soon after the blossoms fall. It should be specially noted in this connection that Bordeaux mixture should be only half strength for plum trees. Some varieties, especially those of the Japanese group, have the foliage seriously injured by strong Bordeaux. Perhaps the best formula for this work is as follows: —

| | |
|---|---|
| Fresh unslacked lime, | 3 pounds. |
| Copper sulphate, | 2 pounds. |
| Water, | 50 gallons. |

The mixture is then made up in the usual way, and applied with a nozzle throwing a fine, misty spray.

### MARKETING.

A considerable sale can be found for plums in all the markets in Massachusetts where they are properly handled. Very early varieties and late varieties are found to be the most profitable. For local markets, where the fruit is sold from fruit stands, the common quart berry box is a convenient package. Sometimes the small five-pound grape basket with stiff bale seems to please customers. In selling the bulk of the crop to local customers for canning purposes, the sixteen-quart Jersey peach basket is one of the most satisfactory of all. The eight-quart (one peck) basket pleases a good many customers who do not care to buy plums by the half bushel. Where good plums are to be shipped a considerable distance, the six-basket Georgia peach carrier is found very satisfactory.

# HATCHING AND REARING CHICKS BY NATURAL METHODS ON THE FARM.

BY JOHN S. ROBINSON, EDITOR, "FARM POULTRY."

A leading manufacturer of incubators is my authority for the statement that there are in the United States and Canada about one hundred and thirty concerns manufacturing incubators and brooders. Many of these are small establishments, whose separate output is comparatively insignificant, but the aggregate output of these small factories must be very large, and there must be fully two score of concerns manufacturing on a large scale, the largest turning out hundreds of incubators and brooders daily. Though the total production of these machines for the hatching and brooding of chicks is greater now than ever before, it has for years been large, and when we consider that a well-made incubator ought to last for a good many years, it would seem that the increasing number of incubators and brooders sold must indicate a general substitution of artificial for natural methods of hatching and rearing chicks, and the early advent of the era to which some enthusiasts in artificial methods look forward, when the hen will have nothing to do but produce eggs.

The incubators and brooders sold do not necessarily represent hens put out of commission as mothers. To just what extent they actually displace hens it would be impossible to determine, but where they are most used their service is either in supplementing natural methods or in lines which could not be developed on a large scale by such methods. The incubators and brooders sold also go very largely into the hands of beginners in poultry keeping, who, without any actual knowledge of methods upon which to base a preference, take the artificial method as presumably the latest, most scientific and most up to date. Then there are always poultry keepers expert in natural methods who for various reasons want to try the other system, while the enormous volume of advertising artificial methods keeps constantly before the public, often in grossly exaggerated statements, the advantages of such methods. So it might well be said that the great output of incubators and brooders goes to meet fictitious as well as real demands. It may also well be said that by different manufacturers these demands are met with machines of very different quality and possibilities, and as one result of this state of affairs an enormous proportion of the incubators and brooders sold each season does not go into permanent, practical use.

Thousands and thousands of the cheaper machines will hatch well only while new, and under the most favorable circumstances. Thousands of poultry keepers who buy good machines never learn to run them satisfactorily. They may continue to use them experimentally for some years, but in the end they go back to natural methods as easier and better for them. And the question which is the better method in the end comes to a question of circumstances and of the aptitudes of individuals. Some people can do so much better with artificial methods that they prefer them under any circumstances. Some can use either method successfully. Others get their best results by natural methods. So natural methods continue to be used and used very extensively, and, further, the competition of methods has without doubt served to give a better general understanding of the weak points of natural methods and the best ways of treating them.

However much he may in his innocence have been deluded by the representations of those interested in selling the goods, the operator of incubators and brooders soon finds that these mechanical contrivances are not self-operating. He has to tend them constantly and carefully, and give a great deal of thought to what at first seemed the trivial matter of putting into practice the few simple directions for operating which accompanied the machine. He learns in time (if he succeeds) that to have his machines work well he must, in working with them, be methodical and regular, and, as far as possible, furnish conditions of operation which are favorable.

Favorable conditions, regularity and system seem necessary and fitting parts of a method in which mechanical contrivances have an important part, but all do not readily see their importance in methods when results do not depend upon them absolutely. So it happens that in the hatching and rearing of chicks by natural methods there is too often nothing resembling a system, and no well-advised effort to get all the benefits of natural agencies while avoiding the losses which are apt to occur when natural agents are not well ordered.

The farm furnishes as near an approach to purely natural conditions for the production of poultry as we can have for domesticated fowls, yet it is a most exceptional farm that offers conditions which admit of leaving the poultry — particularly the young poultry — to itself. In a state of nature the tendency is for such creatures as fowls to maintain themselves in about the same numbers on the same area year after year. This means that the great majority of the young produced must succumb to their natural enemies or to the rigors of natural conditions before reaching maturity. Now, though the domestic hen may be far more prolific of eggs than her wild counterpart, she is also an expense to her owner, and his profit upon her is measured not by the number of eggs she may lay but by the difference between the value of her produce and the cost of her keep. In the matter of eggs, it would be no great advantage to the owner of hens that they were great layers if their eggs were lost or destroyed. So it is usual for poultry keepers on farms either to make provisions for the poultry which compel the hens to lay in the places provided for them, or to keep close watch on all places within the range of the flock where hens might lay, and collect all eggs while in good condition. There may be a percentage of loss between the laying and collecting of the eggs, but it is not often a very large one.

In the hatching and rearing of chicks come the heaviest losses of most poultry keepers on farms, and to a very great extent these losses are not necessary and could easily be avoided. To make separate special provision for the losses from all possible different sources is not practicable. The practical and effective way to avoid losses and make the most of natural facilities for hatching and growing chicks is to systematize the work, and make the same sort of provision for getting full results from natural methods as is usual when artificial methods are used.

The incubator operator provides for his machines a place where, to the best of his judgment, conditions are favorable. The poultryman hatching with hens too often provides no suitable place, or sets hens any way and in any place. The brooder operator provides very carefully for his chicks and for his own convenience in caring for them, but when hens do the brooding, there is apt to be too great variety in accommodations to admit of uniformity in treatment, and, while that may mean some saving in cost of equipment, it usually means also an increased cost of labor, and whether it is labor he does himself or labor he pays for, the increased cost of labor comes out of the poultry keeper, either in the form of harder work or as diminished product and profit.

Provide for the setting hens exclusive quarters, and for the hens with chicks coops of substantially the same size and type, and a piece of land of such extent and character that the chicks have all the advantage of range and freedom without being so much scattered that the work of looking after them four or five times daily is too laborious.

If this is done, and a reasonable amount of attention given the chicks up to the weaning age, losses up to that point should be small, and the stock on hand at that stage much better developed than when the work is not so thoroughly done.

When any considerable number of chicks is to be hatched by hens it is advisable to set as many hens as possible at the same time, and preferable to have a certain day of the week for setting hens, and set none at other times. This simple little point of practice introduces at once an element of regularity in the work which would have a marked influence all through, even if no other effort to secure regularity were made.

Make the nests in banks or tiers, built up like shelving in a store, or perhaps more graphically described as resembling a sectional bookcase. The nests need no back, for they are placed against the wall. The fronts should have covers of slats, or of a board just wide enough to leave space for air above and below it. Each cover should be the length of a section, opening and closing all nests in one section together. The covers should be hinged at the bottom (leather hinges will do), because they must be fastened when closed, but if hinged at the top, they must be fastened to keep them open as well. Besides this, the cover front hinged at the bottom may be used as a running board in front of the nests if so desired. For ordinary hens nests should be twelve inches square, inside measurement. For nesting material use short, fine hay or broken straw, and shape the nest well with the hand. If the nest is not shaped before the eggs are put in it, and the material well pressed down, eggs are likely to be broken during the first days of incubation.

Set only hens that are evidently in good health, and give the preference to those in fair flesh. Set no hen that is not easily handled after dark or that will fly from the nest if approached by daylight. To have hens that are healthy, quiet and easily handled means freedom from a large portion of the usual losses in the early weeks of the chick's life, as well as during incubation.

Select for incubation, eggs of uniform size and good form and color. If for any reason it is desired to set some eggs larger or smaller than the average, sort the eggs and give the special sizes to separate hens. The rule of thirteen eggs to a hen is a good one to follow if all nests are twelve inches by twelve inches. Some hens can cover more, but, for a reason which will shortly appear, the number of eggs should be adapted to the smallest hens in the lot. If nests are of different sizes the largest nests and hens may have more eggs, though fifteen is as large a number as it is advisable to give any hen.

Have the hens come off for food and water daily. If a large number of hens are set at the same time — all the apartment will contain — they may all be let off together and the nests closed while they eat, drink and dust themselves. If the floor is of earth, without too much broken droppings in it, no special dusting box need be provided. The food should be corn or other hard grain, corn preferred, and whole corn used rather than cracked corn. For the first few days the hens should be watched closely, to prevent fighting. After they become used to the place and to each other, the attendant may let them out, close the nests, and leave them until time to return them to the nests, — twenty minutes to half an hour. In returning hens to the nest make no effort to have the hens go back to the same nests. On the contrary, if any are noticed which persistently take a certain nest return them to another. By doing this all eggs have the same treatment. A hen that, if on the same eggs continuously for three weeks, would make a poor hatch, is never on one nest long enough to specially affect the eggs in it, and the results are better average hatches and a larger total hatch.

Dust the hens with an insect powder when setting them, again about the tenth day, and again about the nineteenth day, just before the eggs begin to pip. After the hens return to the nests remove the droppings before they are broken into the floor, and the place will be free from the peculiarly offensive odor too common where hens are setting.

Test the eggs the seventh day and again the fourteenth day. A metal chimney for testing, which may be used with a common lamp, may be purchased at any poultry supply house. An infertile egg remains clear throughout the period of incubation. A fertile egg at the seventh day shows quite opaque, with the air cell at the larger end sharply defined and in the same position with reference to the shell as the egg is turned before the light. If the germ is dead, but the egg not yet decomposed, the dead germ may show as a dark or bloody spot in the opaque contents of the egg. If the egg is rotten, the line of the air cell will remain horizontal as the egg is turned before the light.

Unless fertility is exceptionally good, enough eggs will be taken out at this test to release one or two hens, the eggs from their nests being used to fill others, and they either reset with the next lot, or returned to the laying pens. If the eggs were fresh when set there will rarely be rotten eggs to take out at the first test. The test on the fourteenth day discovers most eggs that will not have full-formed chickens at the end of the period of incubation, and it is important that these should be removed, for the rotten egg is the egg that breaks, and broken eggs not only make a nasty mess to clean up, but injure the chicks in the eggs which are soiled, and thus reduce the prospects of a hatch. Unless an unusual number of eggs should be taken out at the second test, it is as well not to double up again.

After the eggs begin to pip keep the hens on the nests until the hatch is completed. This will usually be in thirty-six hours. Look into the nests enough to see that things are progressing right, to clear away shells as they accumulate and to see that no chick is smothered by an empty shell capping the egg containing it. If a hen is so restless that she tramples her chicks, exchange her for a quieter one from a lot set later.

When the chicks are all dry remove them from the nests to coops previously made ready for them, giving each hen from twelve to twenty chicks, according to the season. Select as mothers the hens that are in the best condition and most thrifty looking.

Up to this point the farm has offered no special advantages over what would exist anywhere where there was a vacant pen in the poultry house, or a convenient shed or outbuilding that could be used for the sitters. From this point the farm has great advantages, and they should be fully utilized. Even a farm too small to give fowls free range without their trespassing on neighbors has advantages far surpassing those of the town poultryman, who must make up for lack of natural advantages by special care to provide variety in food, to maintain a healthful cleanliness and to guard against the evils incident to the crowding of chicks on limited areas.

What farm is so small that, if the matter were systematically provided for, it could not furnish new ground, on which the grass was well established, each year for the little chicks? With hay at the prices which prevail in Massachusetts it seems sometimes almost a crime to put chicks on mowing land before a crop has been taken from it, but if there is no part of the pasture or orchard available for small chicks, and convenient to the house, it will certainly pay the grower of chickens to give up to the smallest of them a piece of grass land as large as they need. That would be a piece as small as they could keep the grass down on without killing it out. In an ordinary season this would be a piece as large as required to place the coops about two rods apart each way and have a margin about two rods wide outside the coops all around the plot. In a wet season, or where the growth was rank, the coops should be closer together; under the opposite conditions, farther apart. The loss of hay from the land given up to the chicks would be at least in part made up by the heavier crop from the piece next year, for the droppings of the chicks will distribute quite evenly over it a high-grade fertilizer, while whatever waste of food there may be is not lost, the waste going to enrich the land.

Supposing a piece of mowing land on which the grass is well up is to be devoted to the little chicks. It should be mowed before they are placed on it, because if left long the chicks would get too wet running through it when the dew is on it in the morning and on wet days; and so it would be necessary to keep them shut in the coops more than is desirable. In respect to chicks running in wet grass it may be said that rugged chicks are not injured by it in ordinary weather, when the sun and air dry them quickly, and when the hen, confined to the coop, keeps dry, and if wet and cold they can go to her and be quickly warmed and dried; but weakly chicks do not stand much wetting, nor can any chicks stand much wetting if they cannot quickly dry themselves after it. Let chicks run when conditions are favorable, at other times keep them confined. When there is so much unfavorable weather that chicks would be shut in too much if this rule were followed, keep coops in the same places long enough to keep the grass short around them, and keep a dish of dry feed — shorts and meal mixed dry will answer — beside the coop, that the chicks may remain near it.

If the plot given to the chicks is convenient to the house the chicks will nearly always get better attention than if it is at a distance, because then the care of the chicks will interfere less with other work. On some farms, where large numbers of chicks are grown, the men do the morning feeding, watering, cleaning and heavier work, and close the coops at night, the women feeding them at intervals through the day. When it is too inconvenient to make several feedings daily, food may be kept by the chicks, but that practice is not to be recommended unless they have a much larger range than indicated by the arrangement of coops suggested.

Ordinarily, coops placed in that way should be moved their own width or a little more daily, until the original position of the next coop in line is reached, then backward or forward the length of the coop, and back toward the original position. Moving this way is done when the coops are opened or closed, and the time taken is scarcely noticed.

The best results in growth and development will be obtained by alternating hard and soft foods. Give a mash in the morning, shorts and meal in equal parts, with a little beef scraps added; a feed of grain, wheat or fine cracked corn about 9 o'clock; mash again at noon; wheat or corn about 4 o'clock, and mash just before dusk. The grain foods may be scattered at the time the mashes preceding them are fed, if conditions are such that the chicks do not soil the grain too much before they eat it. When grain is soiled by their feet, even on quite clean ground or grass, it becomes in a degree poisonous and dangerous to the chicks, just as filthy water is.

To many the idea of feeding whole wheat to little chicks may be novel and seem absurd, but the writer has done it for the last fifteen years, and grown as good chicks and lost as few as when only very fine grain was given early. Chicks start slower on a diet in part of hard grain, but develop better digestive capacity, and later will stand heavier feeding and develop better than those kept too long on soft food. To keep chicks free from lice dust them with insect powder when taken from the nests, then once a week for three or four weeks.

By the time the chicks have outgrown their first piece of ground there should be other places on the farm to which they could be transferred. For the weaned chicks, coops about three feet by six feet, easily moved about, called "roosting coops" by poultrymen, are as good as anything. These may be placed on mowing land after the first crop of grass is off, or at the edge of a corn field where the corn is well started, or a piece of asparagus on which cutting has ceased, or anywhere that the chicks can have room without damaging anything. In general, it may be said that when they can do no damage they always do good. The one most important point in growing chicks is to give them plenty of land room. Many poultry keepers are careful to keep coops scrupulously clean, but are rather indifferent about soiled and contaminated ground. This is not strange, for the great advantage of a good range is not often apparent except to those who compare the development of chicks on land that looks clean, though it shows the wear of chickens on it, and on land which furnishes more liberal range. After fowls are grown they will stand close confinement, but growing chicks should have room, and if limited for room must have special care to compensate.

The feeding of the chicks after weaning should continue along the line on which they were started. Unless the land furnishes an unusual amount of food, it will pay to keep up the four or five feeds a day, until they begin to be indifferent at some of the feedings. Then omit one feed, — the soft feed at noon. When this point is reached the chickens will get along very well with no attention between the time the hard grain is given them in the morning and the time for feeding it in the evening. At both feedings it should be well scattered, and the evening or afternoon feeding should be several hours before sundown to give them ample time to eat a feed of the scattered grain. Then just before dusk give them all the mash they will eat. They will eat quite a hearty meal of this after they have fed to a surfeit on grain, and will make growth proportionate to the quantity of food eaten.

The methods I have outlined call for nothing expensive in the way of appliances, nor do they call for a great deal of work. There is nothing in the equipment suggested but what any handy farmer can make himself, often from waste lumber or from material purchased at a trifling cost. The prevailing idea is to have things suitable for the purpose to which they are put and convenient for the attendant. This means uniformity in equipment and system in care. By observing these two points, and by studying to keep the chicks as much as possible on land under cultivation or in grass, the farmer can at the same time avoid heavy losses of chicks and greatly increase the poultry-carrying capacity of his farm.

# BEE KEEPING: SOME SUGGESTIONS FOR ITS ADVANCEMENT IN MASSACHUSETTS.

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Apiculture is proverbially the poetry of agriculture. Of agriculture George Washington said: "It is the most noble industry of man." We would therefore flatter ourselves in being fortunately interested in an art, worthy of the most strenuous efforts to advance it.

As a business proposition, notwithstanding the general belief that the business end (of the bee) is not worth while, we have sufficient evidence from all thrifty bee keepers, in all States, that keeping bees pays. Not a little care is necessary, and this attention is imperative at just the right moment; but on the investment the interest is great.

Some have considered that bee keeping has had its day; true, the old style. We have done with the box hive and with honey strained through an old body-blanket, as the Indian used to do. We have found that the crops can be increased, the ease of procuring them increased and the profits advanced, by modern manipulation.

Awakening, renascence, rejuvenation, modern-method progress, larger crops and better prices symbolize bee keeping to-day. Massachusetts is no exception; she responds to the stimulus with the world as a whole. But as yet the response is not general; it is noticeable only here and there, as some one is having his eyes opened to the fact that several times the old returns from a colony of bees are possible under modern manipulation. Furthermore, we must better realize the unquestionably good resources in this State, which are constantly going to waste unutilized. We believe it possible for bee keeping in Massachusetts to rival that of any of the northeastern States; in order to do it, however, we must first become acquainted with the resources of the State, with modern manipulation, and then spread wide the news among all bee keepers.

Before we consider how to better the existing bee industry, and before discussing the natural conditions for the industry in this State, we may well observe what a few have demonstrated *can* be done with bees by no more than a little judicious manipulation.

### What can be accomplished.

The following observations were made from returns to a series of questions sent to the members of the Worcester County Bee Keepers' Association. A similar set of questions was also reported in the previous year, to which reference will also be made. These comparative results figured on the crop of 1905 and 1906 are merely an index of what can be done with bees by those who know how and who are willing to give the attention; they do not in any degree represent the status of the industry as a whole.

The observations are based on the work of but 38 bee keepers, who had, in the spring of 1906, 359 colonies, and who increased to 527 colonies in the fall, or an increase of nearly 50 per cent. More remarkable still, there was a significant honey crop along with this increase of bees. Of comb honey we are reported 10,117 pounds; of extracted or strained, 6,098 pounds; or a total of 16,215 pounds, which is equivalent to nearly 8¼ tons. Consider this, a season's work of only 38 unpretentious kee keepers, who have three or four to a few dozen hives, and who keep bees only that they may supply a limited local trade or their own tables, or, as one man tells us, because "I like to have the industrious fellows around." It is no record to be ashamed of; is it not a cheerful index to what can be done in the State?

Summarizing, we find that the average yield was 45 pounds per colony, spring count. As compared with the previous season, 1905, this was 10 pounds better per colony. Now to compare with the figures of the United States census for 1900, which puts the yield for Massachusetts at 13 pounds per colony. These census figures are generally considered as unsignificant and not well founded, but nevertheless they go the world over, representing the State's capabilities. According to our figures, they are at least 32 pounds per colony from a reasonable average. Furthermore, these 38 bee keepers set a higher standard than the census report for the famous honey-producing State of California, which we are told averaged 28 pounds per colony. The same objection is also pertinent here, as in the census figure for Massachusetts, but will nevertheless permit of just comparison with our society's returns.

We most assuredly realize that on so few returns as 38 out of several thousand possible bee keepers in the State, it is not safe to place too much emphasis and significance. We may, however, especially since we know personally most of those who made these returns, know their methods and know their purposes in keeping bees, say that these figures reveal more correctly than does the census report, for instance, the truly existing circumstances and possibilities in Massachusetts. They especially represent what is possible for every one who has bees and who is willing to learn how to manipulate them, which, by the way, is as much easier than the shiftless, let-alone bee keeping as to live neatly is easier than to live slovenly.

It is not the purpose of this paper to tell how to keep bees, and it is far from the purpose to stimulate and prompt new bee keepers; but it is rather to stimulate those who now possess bees, to keep them better. We also hope to encourage our readers by possibly indicating to them the superior resources of the State, and to suggest to them some immediate steps which will help them to become better bee keepers. With this index of what is possible, and a prospect of doing better bee keeping, in mind, let us consider, before regarding the essentials for an advance in Massachusetts, the superior resources of the State which we have for several years been observing. In meeting with the bee men of different parts of the State and in talking with them at their conventions, in studying the flora in different localities, and in observing the markets, we have become convinced that Massachusetts is peculiarly fortunate.

## Resources of the State.

Vermont and New York are famous honey-producing States, both from the size of their crops and the quality of their honey. In a more limited area, Massachusetts combines most of the desirable conditions of both these States. For instance, in the Champlain valley of Vermont the crop from white clover is superior and large. In Massachusetts the Connecticut valley has a tangle of clover, and, what is more, it is supplemented by fall flowers, golden rod and asters, which are excellent nectar yielders. In this valley we are told that the flow is almost continuous from spring, when the fruit blooms, until the asters and the golden rod have been killed by the frost in the fall. In the northern part of the State is a belt of bass wood, which, too, is found in sections of Vermont and in New York, and which is reported a heavy yielder in Massachusetts. There is also a superior yield of raspberry, so prized in Michigan. Looking to the coast, we find a flora peculiar to that section. It is hardly to be expected that a good crop could be taken from the sand of the Cape, but clethera and sumac, supplemented by shore plants abounding there, produce, to our knowledge, a surplus of a fine grade of honey.

Much of the State is under cultivation, where bees will surely thrive, especially if there is orcharding and production of clover crops. Some of the most delightful honey in the world is taken in the fruit belts, from apple bloom. The first prize extracted honey at the Worcester Bee Show, 1906, was from this source.

## Climate.

The New England climate, sometimes looked upon as the great hindrance to the industry, is not so bad, after all, if you are careful and know how to manipulate. It does interfere with the nectar secretion at times; but, on the other hand, is responsible for much of our fine honey. The winters, by some, are supposed to be dangerous to bees.

But these are not hard to cope with if you will but take pains to see that your bees are strong, and that ordinary protection is afforded them. (Some hints of how successful bee men manage will be found below.)

### Market.

In the peculiar condition of the market of Massachusetts there is a mine for the bee keeper. In no other State is there the combination of harvest and market which is to be found here. In a relatively small area we have a huge population who are hungry for good honey. Here is the key to a situation. Produce your honey, and sell it close at hand, to your neighbor, in your own town, or in an adjacent town. It is an opportunity which is prized by bee keepers in the west, and one which only the east, particularly Massachusetts, can command. This is not sufficiently realized by most people; but it is the future of the honey trade and the bee man's profits in Massachusetts. Were you living in the west, it would not be possible for you to dispose of your honey at home; but here it is not only possible for you to sell all that *you* can raise, but, with proper management, to buy and retail successfully. In other words, you have in Massachusetts an almost unlimited demand to fill, with a local crop at present limited.

We have indicated, in our paper, "Bee Keeping: how to meet its Difficulties and Dangers,"[1] the huge honey importation yearly from California and from Vermont. A large portion of this the State could herself produce, and pocket the profits. At present she produces less than one-fourth what she consumes, and at that the average allowance each year per capita is but two tablespoonfuls.

But the significant point is this: let the crop be doubled, and doubled again, let the importation to the State go on just the same, and you would still find the market good. It might be necessary to promote the home trade; but from our observations a judicious amount of this will pay.

### Crop of the Country.

In this connection it may be of interest to know something of the honey crop of the country, as figured by Dr. E. F. Phillips of the United States Department of Agriculture, expert in charge of apiculture.

As opposed to the doubtless incorrect figures of the census, which put the United States crop for 1899 at 61,000,000 pounds, it has been estimated that 200,000,000 pounds more nearly represent the annual crop of honey. This estimate is based on the fact that in two States 50,000,000 section boxes are manufactured yearly. The crop of extracted honey can well be figured at twice the crop of comb, which would approximate 200,000,000 pounds of honey yearly, or enough to fill 10,000 freight cars, which, in a straight line, as one writer has said, would reach from Detroit to New York City. Were this crop to sell at the extremely low figure of 10 cents per pound, the industry would represent $20,000,000. But this is exclusive of the value of the bees and of the wax crop, which would bring the figures high. Moreover, in order to get an approximate valuation of the worth of the bees to the country, we would have to add to the sum of the items above that incalculable figure which would represent the value of the bees to the fruit producers of the country. This would bring the figures far beyond the human conception.

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[1] Agriculture of Massachusetts, 1904, p. 411.

In these huge money values we have not reached our limit. We have scarcely begun to utilize the bees. But advance with so small a creature and one so imperfectly understood is slow. With the hope of helping some one to climb a rung higher in the art, we venture to suggest a few items which appear imperative to the immediate progress of apiculture in Massachusetts.

When we conceive of the vast power of a bacterial or germ disease in the human race, and the havoc it plays if unchecked, we can conceive of the damage possible if such should get headway among bees.

## Diseases of Bees.

There is no one factor, we are convinced, which has worked and is working, unconsciously and unknown to most bee keepers, so much damage as are the diseases of bees. While they have been known to exist and have been recognized for centuries, they have not been understood by the majority of bee keepers. A man loses a colony of bees from no apparent cause. He immediately attributes it to "bad luck," because the "bug" which caused it is not large enough to be seen. Or, if the moth has entered, and a "bug" is really large enough to be seen, then the loss is due to the moth, which, in reality, is probably only secondary.

Not infrequently do we hear of some one losing all his bees at one stroke. It is recorded that for some reason the industry in certain localities of Massachusetts has slowly dropped out. We hear the farmers say that fifty years ago "nearly every farm had bees." Our good people wonder why it is that bees are not kept in their neighborhood. Why these observations?

We believe that in a large measure disease is the answer. Unconsciously to the bee keepers of the State, this great natural force has been at work weeding out the bees of the country. It is high time that every one who has bees should become thoroughly acquainted with the now recognized diseases. Of these there are two which attack the brood, and upon which the National Department of Agriculture is at work. They are as follows: —

American foul brood, which is most widespread in the United States, and which is due to a micro-organism (plant) known as *Bacillus larvæ*, White. We quote the symptoms as given by Dr. E. F. Phillips (Bureau of Entomology, Circular No. 79, United States Department of Agriculture): —

> The adult bees of an infected colony are usually rather inactive, and do little toward cleaning out infected material. When the larvæ are first affected they turn to a light chocolate color, and in the advanced stages of decay they become darker, resembling roasted coffee in color. Usually the larvæ are attacked at about the time of capping, and most of the cells containing infected larvæ are capped. As decay proceeds these cappings become sunken and perforated, and, as the healthy brood emerges, the comb shows the scattered cells containing larvæ which have died of disease, still capped. The most noticeable characteristic of this infection is the fact that when a small stick is inserted in a larva which has died of the disease, and slowly removed, the broken-down tissues adhere to it, and will often stretch out for several inches before breaking. When the larva dries it forms a tightly adhering scale of very dark brown color, which can best be observed when the comb is held so that a bright light strikes the lower side wall. Decaying larvæ which have died of this disease have a very characteristic odor which resembles a poor quality of glue. This disease seldom attacks drone or queen larvæ. It appears to be much more virulent in the western part of the United States than in the east.

European foul brood, which is getting hold on New England and in which is found *Bacillus alvei*, causes the most rapid loss abroad. Along the New York State boundary of Massachusetts and in other sections of this State the disease is known to occur. Again we quote Dr. Phillips, from the same paper: —

> European foul brood (often called "black brood") is not nearly as widespread in the United States as is American foul brood, but in certain parts of the country it has caused enormous losses. It is steadily on the increase, and is constantly being reported from new localities. It is therefore desirable that bee keepers be on the watch for it.
>
> Adult bees in infected colonies are not very active, but do succeed in cleaning out some of the dried scales. This disease attacks larvæ earlier than does American foul brood, and a comparatively small percentage of the diseased brood is ever capped. The diseased larvæ which are capped over have sunken and perforated cappings. The larvæ when first attacked show a small yellow spot on the body near the head, and move uneasily in the cell. When death occurs they turn yellow, then brown, and finally almost black. Decaying larvæ which have died of this disease do not usually stretch out in a long thread when a small stick is inserted and slowly removed. Occasionally there is a very slight "ropiness," but this is never very marked. The thoroughly dried larvæ form irregular scales, which are not strongly adherent to the lower side wall of the cell. There is very little odor from decaying larvæ which have died from this disease, and when an odor is noticeable it is not the "glue-pot" odor of the American foul brood, but more nearly resembles that of soured dead brood. This disease attacks drone and queen larvæ very soon after the colony is infected. It is as a rule much more infectious than American foul brood, and spreads more rapidly. On the other hand, it sometimes happens that the disease will disappear of its own accord, — a thing which the author never knew to occur in a genuine case of American foul brood. European foul brood is most destructive during the spring and early summer, often almost disappearing in late summer and autumn.

It being impracticable here to give detailed discussion of the treatment of these diseases, we would refer you to the above-mentioned circular, which can be had free upon application, or to a more full account of both the treatment and character of the disease: The Bacteria of the Apiary, with Special Reference to Bee Diseases, Technical Series No. 14, Bureau of Entomology. Price 10 cents. This bulletin may be had from the Superintendent of Documents, Washington, D. C., at the price affixed.

We urge every one who has not already a copy of this paper, the most up-to-date work on the subject in any language, to secure one.

### Get Rid of the Box Hive.

Do not allow one to persist in the country. In order to progress in bee keeping, there is nothing more detrimental and hindering.

A box hive is an absolute handicap to any bee keeper. If there is any brood disease in his region, the box hive is a sure trap, and endangers all the bees for a radius of miles. In it the disease can get headway and exist for a long time without being discovered, unless you are unusually familiar with its symptoms. The colony in the hive weakens; robber bees enter, fly back to their hives, and nine to one contaminate their own combs.

Furthermore, a box hive is of no advantage to the owner. You are limited in the amount of honey you get. You can not inspect your bees, nor force them, nor build them up when necessary. You simply have to let them alone. However, if this be your policy, you can as well have your bees in a frame hive, and at least set the good example, or have semblance, of up-to-dateness.

It is not difficult to transfer your bees from box to frame hive, if you do it in the spring, or fourteen to eighteen days after a prime swarm. It is then that the brood and honey are light, and of little hindrance.

### Transferring from Box to Frame Hives.

The methods of transferring are all essentially the same. Fundamentally, it consists in driving out the bees with the queen, which is imperative, and cutting out the combs. These, as you wish, may be fitted into frames and given back to the bees in the new hive, or may be melted down for the wax and honey.

When preparing for a transfer, make ready a frame hive. Have also a "forcing box" about the diameter of your box hive, into which to drive the bees. You will need for tools a hammer, heavy chisel, broad-bladed bread knife, some strings or tapes or elastic bands with which to secure the combs in the frame, some dishes to receive the surplus combs and honey, and a pail of water in which to wash your hands of honey. For the drumming, two heavy sticks or the hammers may be used.

In making the transfer, a warm day, when the bees are flying freely and are less cross, will be found preferable.

After all is in readiness, we usually commence by pounding for two or three minutes on the sides of the hive with the sticks. This at once arouses the bees to filling themselves with honey. The moment that they appear full and begin to "march" out of the entrance, pick the hive up and move it to some place previously selected, aside from the bee yard. Here you can proceed with less annoyance from the rest of the bees.

Place an empty hive or box on the old stand, in order to catch and save the bees which are returning from the field.

When every bee in the box hive is gorged with honey, turn the hive upside down, pull off the bottom board, and substitute the forcing or driving box, in which you will collect the bees. If this does not make good union with the sides of the old hive, you had best put a strip of cloth temporarily around the joint, so that when the bees march up from the combs they cannot take wing or boil over the sides of the hive, but must go up into the driving box. When once they are fairly started into the box, the cloth may be removed and the box tilted back on one edge, which will receive the jar of the drumming. With the forcing or driving box in position, as described, recommence your pounding. In a few moments the bees will be seen to quit their combs and in regular procession file up into the box. As is said above, the box may be tilted back as soon as the procession is well started.

It will be necessary to keep up this pounding until practically every bee is off from the old combs, when, being sure you have the queen with them, you may carefully lift the forcing box and bees, carry it to the new hive, which should be placed near the old stand, and, as in hiving a swarm, dump the bees either into or before the hive on a sheet, whereupon the bees will enter as would a natural swarm. To avoid robbers, do this in the late afternoon, or on a day when the bees are too busy in the field to rob.

The old hive should now be knocked apart, and what combs are suitable should be fitted into empty frames. It is usually desirable to save all the large, straight combs, especially those in which there is brood; but crooked combs are more bother to fit and manipulate than their worth, and are usually melted for wax.

Unless the transfer is made in very early spring (when the operation should be done in the house, in order to prevent chilling), before there is much honey in the fields, it is not necessary to feed or to give the colony combs of honey. The clean honey is usually cut out and taken to the house; combs in which there are both honey and pollen mixed are fed back to the bees.

As fast as the combs are trimmed and precisely fitted to the inside of the frames, they should be secured by several turns of string or tape or by elastic bands about the frame. The frames may then be hung in the hive, where the bees will fasten in the combs and remove the bindings.

After a little experience a neat operator can transfer rapidly, and do a clean job. The only way to become expert is to begin now, and develop your own mode of manipulation.

## HEDDON METHOD OF TRANSFERRING.

A method essentially the same as the above, but adapted to those of limited time and experience, and to those who are somewhat timid, is the Heddon Method.[1] It consists in forcing or driving into the box, as above, about the time of swarming, nearly all the bees of the box hive colony, together with their queen. Into a frame hive on the old stand and with full sheets of foundation, run the bees, as described above. The old box hive should then be placed a few feet back of the new. If the weather be cool, sufficient bees should remain with the brood of the old hive to care for and keep it warm.

Twenty-one days after this transfer is made, all the brood will have hatched, leaving nothing in the combs but honey. The rest of the bees are now driven out as above, and united with those of the first drive. The old hive may be disposed of when and as you will, but should not be left around for robbers.

If for no other reason than to promote the bee keeping industry, put your bees, if now in box hives, on to frames. See to it also that your neighbors do likewise; you will be repaid many fold.

If we can but rid the State of this one hindrance to progress, the worth of the industry will advance many per cent.

In order to demonstrate how much behindhand you may be, we would remind you that it was in 1851, more than fifty years since, that Rev. L. L. Langstroth devised the movable "frame" hive. Of it, in his journal, Oct. 30, 1851, he says: "The use of these frames will, I am persuaded, give a new impetus to the easy and profitable management of bees." Large bodies move slowly, despite such unquestionable impetus.

## IMPORTANCE OF THE TYPE OF HIVE.

Closely associated with the problem of transferring is the selection of the style of hive to use, and its influence upon the success with bees.

If you would get all you can out of your bees, the type of hive which you use will greatly hinder or increase your results. For instance, as we attempt to show, the box hive is worth almost nothing to the owner; he cannot take surplus in marketable form from the frame. Again, many of the frame hives in use are too small. They cramp the queen, do not allow her to lay to her full capacity, and consequently damper the crop.

Of course to prescribe for everybody's needs is difficult; but for those who use the Langstroth size frame we would advise by all means a ten-frame hive. If possible, use two bodies at that. Your queen, if she is young and prolific, will take care of that number of combs; you will get the returns. Moreover, we believe personally in a free-hanging, so-called "unspaced" frame; it allows more freedom in handling than a "spaced" frame, and where propolizing is heavy, it is a delight. The new frame manufactured to be used with "tin spacers," but used without the tins or the "unspaced frame," has been very satisfactory to the writer.

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[1] Gleanings in Bee Culture, A. I. Root Company, p. 562, 1885.

### Section Boxes.

In connection with types of hives, we would say that the 4 by 5 or other oblong section is promising to market better than the square section. Ask a merchant which of these two sell the better, and his usual reply is the oblong. "It looks larger," say his customers. Æsthetically speaking, an oblong is more pleasing than a square, which doubtless has its unconscious influence on the trade.

### Vigor of the Stock.

Correlated with the size of the hive are the virtue and value of a vigorous stock. If you have colonies which are healthy, but unprolific and lacking vigor, the queens had best be killed and be succeeded by some young, prolific blood. But in a cramped hive, say a box or even eight-frame hive, the most prolific queen may fail to bring results in terms of honey, simply because she has not room. Give the same colony ten or more frames to breed up on, and you may not believe your eyes; you may question that it is the same queen.

Dr. Kirkland, in the "Ohio Farmer," Dec. 12, 1857, upon transferring from box hives three colonies, of which "the first had not swarmed in two years; the second had long ceased to manifest any industry; and the other had never swarmed," says: "Within twenty-four hours each colony began to labor with far greater activity than any of my old stock. . . . I have now no stronger colonies than these."

Where breeding for queens, no pains should be spared in selecting for the most vigorous prolific stock possible. We believe it worthy to disregard looks, color, size, markings and even gentleness, if necessary in order to get a race which will have vitality, vigor and prolificness. This will usually mean honey-gathering qualities as well. Select for a strain of *honey* bees, not, as has been the policy, for "handsome" bees.

To those who are interested in breeding queens, we suggest that they send to the Superintendent of Documents, Government Printing Office, Washington, D. C., for the fullest account of the methods employed which has yet been published. The title is: Bulletin No. 55, Bureau of Entomology, The Rearing of Queen Bees. By Dr. E. F. Phillips. Price 5 cents.

### Wintering.

This problem, while not directly pertinent to the progress of bee keeping, has a direct influence on success or failure. Most of the bee keepers of Massachusetts consider the problem only in terms of "luck" and "bad luck," instead of reasoning intelligently the conditions for successful wintering. In our paper in the Crop Report for 1904, already alluded to, we treated the subject more or less fully. But here we would add a few observations made since then, which may help to enlighten some one on this puzzling subject.

That our winters are severe there is no doubt; but they are no worse than those of New York State, of Vermont, or of Canada, where such extensive bee keeping is done.

In visiting bee yards and talking with bee keepers, particularly the past spring, after the severe winter of 1906 and 1907, I noticed that the careful and painstaking man brought his bees through all right, whether he wintered in the cellar or on the summer stands. It is the merit of cellar wintering which so favorably impressed me, however.

Particular success was observed at the yard of Dr. William P. Brooks and Dr. James B. Paige at Amherst. We saw the bees there in April, about a week after they were brought out from the cellar. Without exception, they were the finest stocks which we have ever seen at this season in Massachusetts. They had not appreciably decreased in numbers during the winter, they were clean, healthy, had large amounts of stores left, and, best of all, had patches of sealed brood on several frames. Moreover, when seen again in the middle of May it was evident, without exception, that they had not "spring-dwindled," as so many of the bees did last spring, but that they had maintained their strength, many of them occupying two ten-frame hive bodies. This shows, too, that they had not been over-stimulated.

Likewise, Mr. H. F. Cary of Lyonsville, who wintered a hundred colonies in his cellar, told us that most assuredly he could not have carried through the number he did had he wintered out of doors.

We can not afford the space here to discuss adequately the features of wintering out of doors or in the cellar, but we will briefly list the essentials for success.

*First*, about 40 pounds of stored honey are necessary to winter a large colony, especially out of doors.

*Second*, the colony should be populous, with plenty of young bees.

*Out-door* wintering necessitates a protection of paper or other wrapping, as described in our paper above mentioned.

*Cellar wintering*, while expensive in the first cost, is a saving in the end. The bee cellar should be dry, capable of easy ventilation and complete darkening. Ventilation will allow the cooling off or the warming up of the cellar at will; the dark will prevent the bees from flying about the room. It is advisable, in order to insure dryness, to have the cellar bottom cemented.

Temperature is a vital factor. The cellar should be furnished with a thermometer. For the best results, the temperature should be maintained at from 35° to 45° F. all winter. In the spring, as the bees begin to breed, it is safe to allow it to go as high as 48°. Over this is likely to make the bees uneasy.

As soon as the weather becomes settled, and the bees have begun to rear brood, it is best to take the bees from the cellar for good. According to the location, this will be in March or early April.

If you have difficulty in maintaining the proper heat, it is customary to reduce the temperature by putting in the cellar for a few hours a cake of ice or some snow. If you need to raise the temperature, you can do so by burning an oil lamp.

It will pay all those who have any number of colonies, or neighbors, to combine to build a bee cellar. The labor of doing this is slight, as is the trouble of putting the bees in the cellar and taking them out; and the security is great. With a little experience and reason, any one will be able to winter his bees this way.

### Caring for the Crop and marketing it.

We have so far considered factors which may facilitate getting more honey and doing a better bee business. But the thought of what to do with the crop after we have it, how to care for it and how best to market it, seldom enters our consideration. All we look for is the honey; we are not particular to keep it sweet, clean and unharmed by the moths.

One of the most difficult things in apiculture is to properly keep and to prepare the honey crop for market. The extracted crop is most easily handled, for it can be run into cans, of the producers' choice, sealed and set away for market. To put up an attractive package of extracted honey is an art, and requires no little thought and skill.

In this connection, we hope that every bee keeper will take pains to send 5 cents to the Superintendent of Documents, Government Printing Office, Washington, D. C., for an admirable paper by Dr. E. F. Phillips and Dr. C. A. Browne, on the "Production and Care of Extracted Honey, with Methods of Honey Testing for the Bee Keepers." This paper, just issued by the Department of Agriculture, should be in the hands of every bee keeper.

Unfortunately, it is difficult to obtain in any convenient, family size package, good extracted honey in our Massachusetts market. It is all in either small glass packages, which are mere samples and are expensive, or it is in cases of two 60-pound cans, which are difficult for the private customer to obtain except through the wholesaler.

In preparing the comb honey crop we can do no better than to follow the procedure of a gentleman who ships the finest comb clover honey which we have ever seen. We have often heard what care Mr. R. H. Holmes of Shoreham, Vt., takes with his crop, and we well know the high rank it commands in the market.

In the first place, Mr. Holmes stores his sections, as fast as they come from the super, in an attic where it is dry and hot (not hot enough to melt the wax). This allows the honey to ripen, and prevents a chemical change in its constitution, which frequently happens if stored in a damp atmosphere.

In the fall, when it is shipping time, each section is carefully scraped and polished until scarcely a stain from the bees remains. The sections are then sorted and graded, — a task, as Mr. Holmes tells us, which requires the most extreme care and experience. Only the heaviest and most perfect sections are put into the first quality. We have seen case after case of twenty sections weigh as high as 23 pounds; that is surely giving full weight. After sorting, the sections are put into cartons and then packed into spotless cases, holding, as we said, 20-pound sections each. The whole is then ready for shipment.

It is frequently necessary to fumigate the combs, in order to prevent the work of the wax worms. This can be done in several ways; by confining the sections either in a room or in a tight box, where they are disinfected with carbon bisulphide, hydrocyanic gas or formaldehyde.

The key to success in marketing is the neatness with which all is done, the maintaining of the flavor and fragrance of the honey by properly storing it in a dry, warm atmosphere; in a word, by presenting a thoroughly clean, wholesome, fragrant and inviting package.

*Never store honey of any kind in an ice box or other damp, cold atmosphere.*

All the suggestions that we could give, if we were to continue for pages, would not help you to progress as much as a little practical experience. Work intelligently with your bees, trying to bring the best results possible, and you will succeed. Keep in touch with what others are doing, by reading. Read all the bee literature you can get hold of, from the four corners of the earth. Some of it, to be sure, will not be worth while, but it is the only way to keep in the advance.

## Bee Keepers' Societies.

Besides reading, untold benefit can be derived from a society. At these meetings enthusiasm runs high; you are in contact with the most active bee keepers of your section, and can, through verbal discussion, learn more than by much reading.

Massachusetts now has two societies. Most central in the State is the Worcester County Bee Keeper's Association, which holds regular meetings the second Saturday of each winter month, beginning in November, in Horticultural Hall, Worcester, at 2 o'clock P.M. The fee of this society is but 50 cents for membership until an assessment becomes necessary, which as yet has never been the case. Full particulars may be learned of Mr. Adin A. Hixon, secretary, Horticultural Hall, Worcester, Mass.

The other society, the Massachusetts Bee Keeper's Society, holds its meetings in Boston, monthly, in places voted at each previous meeting. Mr. F. H. Farmer, president, 15 Chardon Street, Boston, Mass., will gladly furnish details. The fee is 50 cents per annum.

We strongly urge you to co-operate with these societies. They need your support; they will help support and promote you. Through their work and influence largely, the greatest advance and progress in bee keeping are to be expected.

### College Courses in Bee Keeping.

For those who wish to learn bee keeping or the most advanced principles and methods, a course in apiculture is given annually at the Massachusetts Agricultural College, Amherst, Mass., beginning the fourth Wednesday in May, and lasting two weeks. You have the benefit of lectures and demonstrations by four of the regular staff of professors and one special apicultural expert. For particulars write to the registrar of the college.

In conclusion, we would emphasize that apiculture, an ennobling, uplifting, healthful, inspiring, and, to say the least, fascinating and profitable pursuit, must become something more than a haphazard pursuit. "Luck" plays no part; reason, intelligence, experience and skill have far more to do with success. It is our earnest effort and hope to eliminate the more or less general slack and careless methods for that easier, modern, rational manipulation.

Keep your bees; do not let them keep themselves.

# GREENHOUSE PESTS AND THEIR CONTROL.

BY H. T. FERNALD, PH.D., PROFESSOR OF ENTOMOLOGY, MASSACHUSETTS AGRICULTURAL COLLEGE.

The value of crops raised under glass in Massachusetts is increasing each year, and new houses are continually being added to those already in use. Two classes of products are obtained in this way, — flowers and other ornamental plants, and vegetables which during some portions of the year could be produced out of doors, but which when raised out of season command high prices.

Both of these classes of crops, if they may be called such, occasionally suffer severely from the attacks of insects of various kinds, some of which may cause injury to but one kind of plant, while others may affect nearly everything. Losses resulting from the presence of injurious insects in greenhouses are frequently large, and little is generally known as to methods of preventing them. Many kinds of insects may be found at work at different times, and unless the grower knows what the insect is with which he has to deal, he is uncertain as to the proper treatment, for it is now becoming quite generally understood that the nature of the treatment depends to a large degree at least upon the kind of insect to be controlled.

On forcing crops, plant lice, the white fly, thrips and occasionally cutworms, snails and other pests appear. On florists' crops these insects and scales are also too often in evidence. Accounts of some of these pests, and reliable methods for their control, follow.

## Plant Lice.

There are many different kinds of plant lice or aphids, most of which are green in color, and are frequently called "green fly." A black species known as the "black fly" is common on chrysanthemums, and a brown species occurs on violets. All kinds of plant lice, however, suck the juices from the leaves, tender stems and flower buds of the plants they are on, and in this way check the growth, blight the blossoms, and if sufficiently abundant kill the plants. They multiply rapidly, the young being generally brought forth alive, and at first clustering around the mother, sucking the sap from the plant. But after a few days, when more young appear and this region becomes too crowded, they move away to other parts of the plant and continue their feeding.

The mother louse (in one species at least) produces from four to sixteen young every two or three days until about two hundred have thus appeared, and when these young have fed till full grown they in turn begin to produce young. After a few generations of this nature another generation is produced, the members of which develop wings and are thus able to fly to other plants and start new colonies. In this way an entire greenhouse may in a short time become infested from a single originally infested plant.

With most kinds of plant lice a generation finally appears which consists of males, and females which lay eggs, these hatching and producing females which start new colonies; but the egg-laying generation has not been observed in all cases.

### THE WHITE FLY. (*Aleyrodes vaporariorum* Westw.)

This pest has been a very serious one in Massachusetts during the last ten years, often destroying entire crops of tomatoes, cucumbers, etc. In one case seen by the writer a crop of tomatoes valued at $4,000 was entirely lost, the vines drying up completely just as the fruit began to ripen.

The adult fly is a tiny, white-winged insect, with a yellow body, flying quite freely when disturbed, and resting on the plants, chiefly on the under side of the leaves. The eggs, which are too small to be seen without a magnifying glass, are laid there, and the young suck the juices from the leaves. The young are very small, almost transparent, lie flat against the surface of the leaf, and are very inconspicuous. As they feed, the leaves gradually turn brown, and wither when the insects are abundant.

From the time the eggs are laid till adults from them appear is about forty days, so that there is plenty of time in most cases for several generations to develop while a single crop is being grown.

### THRIPS.

Several kinds of thrips are found in greenhouses, but the most common species is the onion thrips, which is often a serious pest to field onions. It is a slender insect, about one-twentieth of an inch long, yellowish brown, and winged. The eggs are probably laid in the tissues of the stems or leaves of the plants. The young which hatch from the eggs resemble the adult, but are smaller and without wings.

These insects, both as young and adults, suck the juices of the plant they are on, the damage they cause being in proportion to their abundance. Each female probably lays about fifty eggs, and the adults from these eggs appear in about three weeks, thus enabling this pest to increase rapidly in numbers unless held in check by some method of treatment.

When the thrips work on the leaves, small spots where the sucking has taken place soon turn brown, giving the leaf a speckled appearance. On flower buds small pale blotches soon show on the petals, spoiling the blossoms. The cucumber and carnation are perhaps the most usual food plants of this insect in the greenhouse.

### Cutworms.

Cutworms are the caterpillars of a group of moths known as *Noctuidæ*, the caterpillars feeding in a variety of ways, though many — perhaps most of them — attack the stems of succulent plants at or near the surface of the ground, and by feeding at one spot "cut" off the stem at that point.

Cutworms usually get into the greenhouse by being brought in with the soil, so that if this has been sterilized properly they are not likely to be present, though in some cases it is possible that the moths may enter through open ventilators and lay their eggs, from which the cutworms will hatch.

The cutworms usually feed at night, burrowing into the ground during the daytime; and the first indication of their presence is the discovery of wilting plants, which examination shows to be due to a more or less complete "cutting" off of the stem.

Sometimes the easiest way to remove these insects is to dig up the soil around the injured plants and find and destroy the worms while they are quiet in the daytime; sometimes a careful examination in the evening by the light of a lantern will reveal them at work; but when neither of these methods is practicable, for any reason, a poisoned mash may be made use of. To prepare this, take sixty pounds of bran or middlings, molasses enough to sweeten well, one pound of Paris green, and water to make a dough or mash. Mix thoroughly, and place a little beside the stem of each plant late in the afternoon. The cutworms coming up to feed at night will find in this mash something which they prefer to the plants, and will be poisoned by it. Smaller amounts than those given above can easily be prepared, using the different materials in their proper proportions.

### Snails.

These pests of course are not insects, but are so often troublesome that they are included here. They are really shells, but forms which appear to have nearly or quite lost their shelly covering. They conceal themselves under boards, pieces of bark or elsewhere during the day, and feed at night. As they move along, large amounts of slime or mucus are poured out to aid them in travelling, and this can be taken advantage of in destroying them. Sometimes it is possible to surround plants attacked by snails with air-slaked lime, which kills the animals when they attempt to cross such bands toward the plants. If for any reason it is not wise to use the lime, similar bands of dry bran may be used, the animal in trying to cross such material soon exhausting its supply of slime and becoming covered by the bran, being rendered helpless and unable to move. Bran used in this way, however, is successful only as long as it is dry, and when it becomes wet must be replaced by a new supply.

### Red Spiders.

These common pests are also not insects, but are mites, having eight legs when adult, instead of six. They vary in color from yellowish to dark brown, and sometimes have a greenish tinge.

The red spiders spin a very delicate web, beneath which they live, the web being difficult to see. They are most plentiful near the midribs on the under side of the leaves, where they may frequently occur in large numbers, sucking the plant juices. They move about freely, however, and may travel some little distance in a short time.

Their list of food plants is a long one, including tomatoes, cucumbers, carnations, roses, violets, and in fact most ornamental plants, which they injure to varying degrees according to their abundance. The eggs are deposited on the under side of the leaves, about five on an average being laid per day, till each female has laid about a hundred. These eggs hatch in three or four days in the warmest weather, but in cold weather this may be delayed to about two weeks. It is probable that from the time an egg is laid till the mite becomes adult requires between three and four weeks.

### The Hemispherical Scale. (*Saissetia hemisphærica* Targ.)

This is usually the most common soft scale found in greenhouses. It is a brown "lump" in form, rather less than a fifth of an inch long, and nearly as broad, and is found on many kinds of plants though most abundant on palms, ferns and cycads. It locates both on the leaves and stems, and in Massachusetts seems to be particularly abundant on the Boston fern. Its life history does not seem to have been completely worked out, but it probably breeds at all seasons of the year, laying eggs which hatch into rather flat, pale-colored young.

### The Soft Scale. (*Coccus hesperidum* Linn.)

This scale is similar to the last, but the young are apparently born alive. It feeds on citrus plants, oleanders and many other greenhouse plants.

### The White Scale. (*Aspidiotus hederæ* Vall.)

The white scale has also quite a list of food plants, but is perhaps as abundant on the ivy, palms and croton as any in Massachusetts greenhouses. It is quite flat, having only a slight elevation at or near the center, is circular in outline, and is white or light gray in color, sometimes with its central elevation orange-yellow. It lays eggs from which adult scales are produced in about two and a half months, but the different generations run into one another, so that almost all stages may be found at any time.

### MORGAN'S SCALE. (*Chrysomphalus dictyospermi* Morg.)

This important pest on palms is circular in outline, dark colored, usually with an orange spot near the center, and is quite flat, projecting only very slightly from the leaf. The young are born alive, and males are unknown. There are several generations in a year, but, as was stated for the white scale, these run into each other or overlap.

### MEALY BUGS.

Two kinds of mealy bug are met with in greenhouses, the more common one having a fringe of spines around the body, the two at the hinder end being somewhat longer than the others. In the less common kind these hinder spines are much longer, — sometimes as long as the body. In both the body is more or less covered with a white, waxy substance, which has been the cause of their receiving the name "mealy bugs."

The several hundred eggs laid by the female are carried under the hinder end of the body, and as these are laid the insect tips upward till it is almost standing on its head. When egg laying has been completed the parent dies, and after about two weeks' time from the laying of the first eggs these hatch. The newly hatched young are quite small, not covered with the wax, and after a time they move about and begin feeding, which continues for six or eight weeks before they become adult, sucking the juices from the plants they are on.

Mealy bugs feed on many plants, but perhaps the oleander, coleus, some palms and citrus plants are preferred members of the list.

### METHODS OF CONTROL.

The widely differing life histories and habits of the various insects found in greenhouses prevent the use of any single method for their control. The treatment in each case must depend upon the kind of insect to be treated, and in many cases as well upon the kind of plant it is on. For some plants the cultural methods necessary to obtain the best results are those most favorable to the increase of their insect pests, while with others a treatment strong enough to destroy all the pests would certainly destroy or at least seriously injure the plants.

#### *Preventive Measures.*

It is almost needless to state that an empty greenhouse should have no pests present, and this will be the case if the house has been thoroughly cleared out and then fumigated, directions for which are given below.

The first step in starting a new crop in a house is to be certain that no pests are brought in with the soil. This can be made sure of by sterilizing the earth thoroughly. Probably cutworms are the insects most likely to be brought in with the earth, and they have located in this while it was outside. Therefore, early in the season select the soil to be used, and throw it into piles. If no grass or other vegetation is allowed to grow on such piles, no cutworm eggs will be laid there, and any cutworms present will go elsewhere in order to get food. In this way where sterilization is impossible at least a considerable degree of protection against the introduction of pests with the soil can be secured.

If the new plants are to be started in pots, these should be fumigated with the house while it is empty. If the plants themselves are grown from seed, they should be free from pests. The real danger under these conditions would be either that the fumigation of the empty house was not sufficiently thorough, or that pests might be brought in on cuttings or in some such way, and spread to the originally clean plants.

All cuttings or potted plants brought into a clean house should be themselves fumigated, or at least dipped into a solution of one pound of laundry soap in a gallon of water for a few moments. The pots should also be thoroughly washed with the soap, as many pests feeding on the plants are often found on the pots as well. Where scales are present on the plants this treatment is not usually a success, and their fumigation must be resorted to.

### *Treatment for Houses already infested.*

*Syringing with water* is of some value for this purpose, if the pressure of the water is sufficient to knock the insects off the plants. Many of the insects crawl back afterwards, however; many are not removed; and many others are not even reached at all by this method, which must be repeated at least once or twice a week. Frequently the amount of water it is necessary to use for effective results in this way is injurious to the plants, the liability of the carnation to develop rust when too much water is used being an example. For these reasons, therefore, the use of water as an insecticide in greenhouses is not particularly desirable where better methods can be employed, unless the plants concerned can stand considerable water, as much more of this is necessary than would be the case in ordinary watering.

*Fumigation with tobacco* is perhaps the most widely used method for the control of greenhouse pests. Either the leaves and stems or some prepared material having tobacco or at least nicotine as its basis is burned in the house, and the fumes are relied upon to destroy the insects present.

Where the leaves and stems of the tobacco, or where tobacco punk or tobacco fumigating paper are used, they are usually placed in pans on the floor and burned slowly, in order to produce as dense a smoke as possible. As the punk and fumigating papers are stronger, they give better results than the stems and leaves, though more expensive than these last.

Certain tobacco extracts are also on the market under various trade names, and, as they contain fixed strengths of nicotine, are more reliable in their actions than ordinary tobacco stems, in which the amount of this narcotic varies considerably. They are usually diluted with more or less water and then heated, producing a vapor which spreads through the house. The objection to these substances is that it is often inconvenient or impossible to vaporize them rapidly enough to obtain a density of vapor sufficient to produce the desired effect.

The insects most successfully controlled by fumigation with tobacco are plant lice, and, when vaporization is successful, some of the thrips. It does not seem to kill all the plant lice, however, for others soon appear, evidently derived from some which had escaped the treatment. The white fly adults are temporarily affected by it and fall to the ground, but most of them soon recover. Red spiders, mealy bugs and scale insects are but little affected.

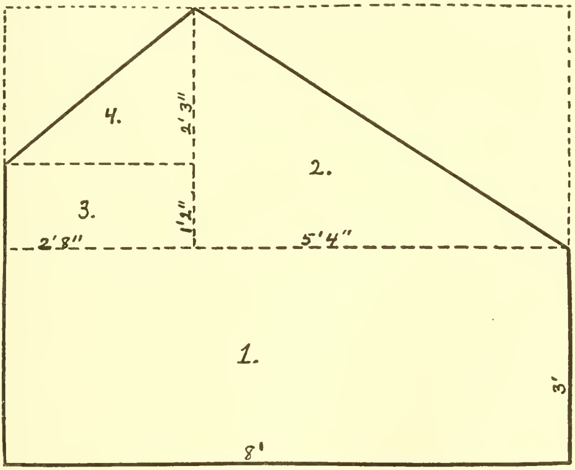
*Fumigation with sulfur* will undoubtedly destroy insects when the fumes are strong, but unfortunately it also seriously affects the plants. For that reason, then, this method of treatment cannot be considered of value in greenhouses.

*Fumigation with carbon disulfid* has been but little tested in greenhouses, the weight of the gas causing it to settle rapidly. A few tests of it for thrips on tomato plants indicate that, used at the rate of one cubic centimeter to each cubic foot of space, the insects would all be destroyed without injury to the plants; but this treatment would probably be successful only on very low plants, placed on the floor of the place to be fumigated, while if enough of the disulfid should be used to reach higher plants the gas would be likely to become so dense lower down as to cause injury. Its use, therefore, can hardly be advised without more knowledge of its capabilities.

*Fumigation with hydrocyanic acid gas* is certainly the most effective treatment thus far discovered; but the gas is a most deadly one, and for this reason many are afraid to use it, and a hearty respect for its powers is a feeling which should be encouraged. If proper care be taken, however, it can be used with safety; and the only other drawback it has is our ignorance as to how much can be used without injury to the plants exposed to its fumes. This subject is now being investigated at the Massachusetts Agricultural Experiment Station, and the maximum strength of fumigation without injury to the plants has been determined for the more common greenhouse varieties of tomato and cucumber at all ages and under different conditions of light, temperature, moisture, etc., and the experiments will be extended to other plants as rapidly as possible.

To fumigate with hydrocyanic acid gas, potassium cyanide, commercial sulfuric acid and water, besides a dish or dishes considerably larger than is needed to hold these materials, are necessary. The dishes must not be of metal, though granite ware, if without any flaws inside, will prove satisfactory. Earthen crocks or jars are often used, and answer well for the purpose unless the heat produced by mixing the sulfuric acid and the water causes them to crack, which sometimes happens when the two are mixed too rapidly.

Before fumigating, the number of cubic feet in the house (not counting out the space taken by plants and benches) must be known, and in many cases to calculate this has puzzled those in charge. The best way to get this is to draw the house in cross-section, and then divide this into squares and half squares or rectangles, as shown in the diagram, which is drawn to the scale of a half inch to a foot. In this diagram, the dotted lines show how the house plan has been divided and the measurements of each part are given. The area of block No. 1 would be 24 feet (3 by 8); that of No. 2 would be so little over 9 feet that the fraction may be ignored (5 feet 4 inches by 3 feet 5 inches, and the answer divided by 2, only half of the rectangle being present); that of No. 3 would be very slightly over 3 feet; while that of No. 4 would be 3 feet. The entire number of square feet in a cross-section of the house, then, would be 39. If this be multiplied by the length of the house inside in feet, the number of cubic feet will be the result.



Fumigation to ensure that no insects are in an empty house can and should be much stronger than where plants are present. An ounce of potassium cyanide to every hundred cubic feet would be sufficiently strong for this purpose, and the fumigation can be given in the daytime, — something which would be impossible if plants were being treated.

The method followed in fumigating is the same, whether plants are present or not, only the strength of the fumigation, the time of day and the time the house is closed differing in the one case from the other.

To fumigate an empty house, weigh the right amount of cyanide on quite accurate scales. This amount should be known in ounces and fractions of an ounce. Then, with such a measuring glass as is used by druggists and photographers, measure out twice as many ounces and fractions of commercial sulfuric acid as there were of cyanide. Thus, if the amount of cyanide for the house, using an ounce to every hundred cubic foot, was 3¼ ounces as weighed on the scales, 6½ ounces of the sulfuric acid should be measured out in the measuring glass. The water should now be measured out in the glass, taking twice as much as was taken of the acid, or — in the example just given — exactly 13 ounces by measure. From this it is evident that, starting with the cyanide, twice as much sulfuric acid and four times as much water are taken, the last two being measured, however, rather than weighed.

As a matter of convenience, it is easier to measure the water before the acid, and put the water in the fumigating dish; then measure out the acid and pour it *very slowly* into the water, to avoid the production of much heat; then all that remains is to add the cyanide.

Before doing this have all ventilators and other openings in the house tightly closed, but so arranged that some of them at least can be opened from the outside. If the house is not very tight, rags should be forced into the cracks, an old case knife being often very convenient for this purpose. Finally, when all is ready, the cyanide, which should be in a very loose paper bag or on a piece of thin cloth, should be taken, cloth or bag and all, and dropped into the dish, the operator at once running as quickly as possible to an exit from the house, which he must then close as tightly as possible.

If no plants are in the house, the longer it is before the doors and ventilators are opened the more certainly will all insects there be killed. Several hours or even a day, then, is none too long for this purpose, and the least time taken should be at least three hours. When the fumigation has been completed, open the doors and ventilators from outside, and let the house air for at least an hour before entering it. The house may now be considered ready to start plants in.

Where plants are already in a house, and fumigation is necessary, the same general method is followed, but with a few changes.

It has been found that fumigation in the daytime is much more likely to injure the plants than at night, though the reason for this has not been discovered. Then different plants differ in the strength of the fumes which they can stand without injury, and this must be taken into consideration. In some cases if the gas be used strong enough to kill all the insects present the plants will be seriously injured, and it is necessary in such cases to use it weaker than is desirable, and repeat the fumigation oftener.

Where a house is filled with but one kind of plant, the problem how strong the fumigation can safely be made is much easier than where many kinds are present. But just how much gas any plant can stand under all conditions has not been ascertained, nor even whether a strong treatment for a short time or a weak treatment for a long time is the safer. For tomatoes it has been found at the Massachusetts Experiment Station that one-third of an ounce of cyanide to every thousand cubic feet of house for forty minutes at night is safe for the plants and quite effective against the white fly. In Maryland three-fourths of an ounce per thousand cubic feet, the exposure to the gas continuing over night, caused no injury; but it is probable that the house used for these tests was not as tight as the Massachusetts one, as this strength injured the plants in this State.

It is necessary to be sure of the quality of the cyanide used in fumigation. Most drug stores carry a grade of about 50 per cent strength; but it is necessary to obtain the 98 to 99 per cent strength, to be at all certain of results. This should be obtained in one pound sealed cans, which state the strength on the outside, and which should not cost over 50 cents per pound. The commercial grade of sulfuric acid is as good as is needed, and its cost should not be more than 10 cents per pound. From this it can be seen that fumigation with cyanide is not an expensive process.

At the present time our knowledge is not sufficient to enable us to use the gas strong enough to kill all the insects. A single fumigation well below the point of danger to the plants will kill the plant lice, most of the white fly, thrips, and some of the mealy bugs. Against their eggs, however, and against most scale insects, it is of little value. But the eggs will soon hatch, and a repetition of the treatment will then reach the young which hatched after the first fumigation. In practice it has been found that fumigation with one-third of an ounce of cyanide to each thousand cubic feet in the house, repeated three times at intervals of twelve to fourteen days, will practically free a house from insect pests except scales and red spiders.

This holds good for tight houses only. If the house is loose and much of the gas becomes quickly lost, larger amounts must be used, but how much larger these may be will depend entirely on how loose the house is.

Where the house is a long one, it is well to divide the charge into two or more equal parts, and start the fumigation at the jar farthest from the door; then drop the other charges of cyanide into their jars as these are passed on the way out.

### *Dipping.*

Dipping wherever this is possible is much better than spraying, as the entire plant is reached, while this is practically impossible by spraying. As only potted plants can be dipped, however, it is often necessary to resort to spraying instead.

Tobacco water, made by steeping tobacco leaves and stems in hot water, is a good insecticide for plant lice, mealy bugs and thrips, but weak solutions are far from effective. The use of laundry soap also gives good results, though for many plants more than four ounces per gallon of water is not safe for the plant, while ineffective against the insects. As a general thing, though, it would be well to try the soap before resorting to tobacco water.

For scale insects laundry soap is usually too weak to be of much value, and whale-oil soap must be used. Fortunately, most cycads, palms and citrus plants can withstand this when used even as strong as one pound per gallon of water, though ferns are injured by such a strong solution.

To dip potted plants rapidly, a tall can filled with the soap is a great convenience, particularly if as tall as are the plants to be dipped. Turn the plant bottom up and plunge it into the can till the wash reaches the bottom of the stem, and hold it there a few moments, then remove it and let it drain before putting it back in its place. In some cases it may seem advisable to wash the plant with clean water after a few hours.

For red spiders, fumigation with tobacco or hydrocyanic acid gas is at best only partially successful. But where the plants can stand it, flowers of sulfur, mixed with water at the rate of an ounce to a gallon, sprayed over them is quite effective. With plants affected by the sulfur it has been found that a 5-cent cake of castile soap dissolved in about six gallons of water forms a spray which gives good results. This spray should be allowed to stay on the plants for two or three hours, after which it should be removed by syringing with clean water. Two or three treatments with castile soap in this way will greatly reduce the number of the red spiders. In some cases drenching the plants thoroughly with a solution of two ounces of salt in a pailful of water has proved quite successful.

# STATUTORY BIRD PROTECTION IN MASSACHUSETTS.

BY EDWARD HOWE FORBUSH, ORNITHOLOGIST OF MASSACHUSETTS STATE BOARD OF AGRICULTURE.

It is common talk, especially in rural communities, that "the more laws we pass for the protection of birds and game the less game we see." A certain section of the press reflects this sentiment, even to the extent of advocating the abolition of the game laws. This is a popular error, arising from a confusion of effect with cause. If we transpose the trite saying, and opine instead that the fewer the birds and game the more laws are passed for their protection, we shall then have the proper relation of cause and effect. When the fact is thus stated it becomes a truism which explains at once that the scarcity of game causes the enactment of protective laws, and that the reason of the depletion of birds and game is to be found in the lack of timely and adequate protection.

A careful examination of the laws that have been enacted for the protection of birds and game since the first settlement of Massachusetts, together with a comparison of the records of the numbers of birds observed during this period, shows clearly why statutory protection has thus far failed to protect, and indicates the remedy by which we may save those species of birds which are not already too near extermination to admit of salvation.

The earlier records of the Massachusetts Bay Colony show no provision for the protection of birds; but in 1632 it was ordered "that noe pson w$^{t}$soeur shall shoote att fowle vpon Pullen Poynte or Noddles Ilelānd but that the s$^{d}$ places shalbe reserved for John Perkins to take fowle w$^{th}$ netts." [1]

Thus a single person was given a monopoly of bird destruction on certain lands.

The continued policy of unstayed slaughter had produced so marked an effect on the wild ducks, geese and swans by the first part of the next century that in 1710 a province law was enacted which prohibited the use, in fowling, of boats or canoes with sails, or of any kind of disguised craft. The preamble of this act states clearly the necessity for its passage as follows· —

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[1] "Records of the Governor and Company of the Massachusetts Bay in New England," Vol. I., p. 94.

> Whereas the water-fowl of divers kinds, which were wont in former years in great numbers to frequent the maritime towns of this province were of great service and benefit to the inhabitants, both for meat and feathers, but are now, in great measure, affrighted and driven away by many persons who have made use of boats or canoes with sails, or canoes or floats trimmed up, covered, or disguised with hay, sedge, sea-weed, ice, cloths or other materials, therein to go off to shoot at them at distances from the shoar upon the flatts and feeding ground, which practices if continued are likely to have the ill affect to cause the fowl wholly to desert and disuse the said towns.[1]

The fine imposed for infractions of the law was 40 shillings, half to go to the informer and half to the poor of the town, and the culprit was estopped from shooting for three years after conviction, on penalty of a similar fine. The act continued in force until March 10, 1713, and was re-enacted from time to time until the revolutionary period, after which it lapsed. During provincial times there appears to have been no other statute enacted for the protection of any species of bird; but the towns were empowered to raise money to pay bounties on the heads of birds and mammals, and bounties were paid on the heads of crows, blackbirds, and the ruffed grouse or partridge.

After Massachusetts became a State apparently no attention whatever was paid to the protection of birds for more than a quarter of a century, for it was not until 1818 that any statutory regulation of shooting was enacted. The preamble to the act of 1818 follows: —

> Whereas there are within the Commonwealth, many birds which are useful and profitable to the citizens, either as articles of food, or as instruments in the hands of Providence to destroy various noxious insects, grubs and caterpillars, which are predjudicial or destructive to vegetation, fruits and grain; and it is desirable to promote the increase and preservation of birds of the above description and to prevent the wanton destruction of them at improper seasons.

This shows that even in those early days there was an intelligent appreciation of the value of birds to man.

At that time the effects of unrestricted shooting had become evident, not only upon the upland game birds, but even on such smaller species as robins and meadow larks. This act (chapter CIII., 1818) protected partridges and quail from March 1 to September 1, and woodcocks, snipe, larks and robins (which evidently were regarded as fair game for all) from March 1 to July 4, but it was nullified to some extent by local option, as the voters of any town could suspend the law's provisions within the town limits for one year by taking action at the regular town meeting. This act, inadequate as it was, signalized the first attempt of the Commonwealth of Massachusetts to protect her upland game birds, notwithstanding the fact that some of these birds had been decreasing in numbers for many years. Dwight wrote in his "Travels in New England and New York," published in 1821, that wild turkeys had then greatly lessened in numbers. Notwithstanding the noticeable decrease they were never protected by law, but were killed off rapidly, and the last bird of the last flock recorded in Massachusetts was killed on Mount Tom in 1851. Evidently protective laws were not the cause of the extirpation of the wild turkey. Like the great auk, it was the victim of unrestricted persecution by man at all seasons.

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[1] "Acts and Resolves of the Province of Massachusetts Bay," Vol. I., p. 667.

It will be impossible, within the limits of this paper, to give even the briefest abstract of the bird laws passed by this Commonwealth since 1818; therefore no attempt will be made to show more than their general purpose and effect. For the convenience of the reader, the legislation for each group of birds will be treated separately.

### WATERFOWL.

After the re-enacted province law of 1710 finally lapsed, soon after the revolutionary period, the protection of waterfowl was not taken up again in a general way until 1886. During the latter part of the eighteenth century and the earlier part of the nineteenth these birds had no protection at any time of the year, except a law passed in 1821 protecting birds on salt marshes between March 1 and September 1. Landowners, however, were allowed to shoot on their own land, and towns had local option regarding the acceptance of the law. No doubt its provisions were nullified by towns in some cases. At that time (1821) Dwight wrote that waterfowl still existed in great abundance. Even then, however, they had decreased in numbers in the waters of the most populous maritime towns, and their flocks continued to diminish, particularly in the interior, for Sylvester Judd in his "History of Hadley," published in 1863, says, "wild ducks were formerly abundant. Now but few alight about our ponds and streams." [1]

By 1865 the decrease of wild fowl, even on the remoter coastwise feeding grounds of the State, had become noticeable, and the people of certain towns began to call loudly for special local protection for the birds. In 1865 the worrying and pursuing of birds by boats on Popponessett and Waquoit bays was prohibited. This was followed in 1867 and 1868 by similar acts for the protection of sea fowl in the waters of Edgartown, Tisbury and Barnstable. Section 6, chapter 246 of the Acts of 1869, was designed to give wild fowl some protection, as it forbade shooting or pursuing fresh-water fowl or sea fowl from, or by means of, boats or vessels of any kind in any of the waters of the State. It also prohibited the killing of sea fowl or fresh-water fowl on the feeding or roosting grounds; but this was repealed the next year, and the use of batteries and swivel guns was forbidden.

By that time, however, the decrease of the more common river ducks, which are in most demand for food, had become so marked that a provision was passed (section 5, chapter 246, 1869) protecting all "fresh water fowl" from March 1 to September 1. The next year a provision was substituted, giving only wood duck, black duck and teal protection from March 1 to September 1. This was the first real respite that these ducks had in this State during the breeding season, and the gunner was still privileged to shoot all other waterfowl at all times.

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[1] Sylvester Judd, "History of Hadley," p. 354.

Now commenced that juggling with the game laws for which the people of this Commonwealth are famous. We tried closing the season for black duck and teal on April 1 in 1875, on April 15 in 1877 and on April 1 in 1881. We protected *all* ducks for the first time in 1886, beginning April 15. In 1888 this date was reaffirmed and remained fixed until 1900, when at last the pitiful remnant of wood duck, black duck and teal that bred in the State were given a little peace by the revival of the first of March as the beginning of the close season. In the meantime, the beginning of the open season for wood duck, black duck and teal had varied considerably but was finally fixed at September 1. All other ducks can still be shot until May 20. A special law was passed in 1888 to prohibit the pursuit of black ducks in boats or floating devices in Plymouth harbor, and in 1900 this was repealed, so far as the use of rowboats and dories was concerned, and its provisions extended to include geese and other aquatic birds. Some local restrictions were enacted during the latter part of the century to prevent the use of sail boats, power boats or other floating devices in pursuit of waterfowl, notably in Boston harbor. In 1906 the use of live decoys for the taking or killing of black ducks in Nantucket County was prohibited. Protection for the wood duck had come so late that the species continued to decrease rapidly in spite of the law protecting it during the breeding season. In 1906 the killing of this bird was prohibited at all times for five years, — an attempt to stay its extirpation which New Hampshire and New York have since adopted.

The sale of ducks and teal during the close season is now unlawful, but only resident black ducks, wood ducks and teal receive any real protection from our game laws to-day, and they get very little, for when men are in the field with guns in their hands until May 20 all ducks will be shot. The northern or red-legged black duck and all other ducks except wood duck, black duck and teal are protected by our law only when most of them are out of the State, and geese can be legally shot at all seasons. Who will wonder that such protection does not protect?

### Shore Birds.

The first protection was extended to shore birds in Massachusetts by chapter X. of the statutes of 1821, framed to prevent the destruction of birds on salt marshes between March 1 and September 1. This act undoubtedly helped somewhat to stay the extirpation of several species. But by 1835 the curlews and other larger shore birds had been so depleted that a law was passed to protect "plover, curlew and dough bird or chicken bird" throughout the State from April 20 to September 1, *at night only*. This law failed to give the birds much respite, and their decrease continued. In 1836 the sale of marsh birds was prohibited during the close season. In 1860 a retrograde step was taken in adding July and August to the open season on the salt marshes.

The slaughter went on without much restriction until 1869, when all spring shooting of marsh birds and upland plover was cut off by closing the season from March 1 to July 1. This was repealed at the next session of the Legislature, and in 1870 the law named the close season for marsh and beach birds as April 1 to July 15, except that "Wilson's snipe, red-breasted, black-breasted and chicken plover," four of the most persecuted game birds, were left without any protection whatever.

From this time forward the law exhibited the usual vacillation in regard to dates from year to year, and the birds were protected most of the time by our statutes only when out of the State, until 1886, when all marsh and beach birds were protected from May 1 to July 15. In 1903 the beginning of the close season was fixed at March 1. After a fight of several years' duration, Mr. Geo. H. Mackay, representing the American Ornithologists Union and the Massachusetts Audubon Society succeeded in securing, in 1904, legislation prohibiting the sale of marsh or beach birds during the close season. This was followed in 1905 by an act protecting the Bartramian sandpiper or upland plover at all times for five years. Before the passage of these acts, however, several species of the larger shore birds had been nearly eliminated from the State. The shore birds have always been inadequately protected, and we still allow shore bird shooting in summer.

## Upland Game Birds.

When the Puritans landed at Plymouth the upland game birds of the colony consisted of the wild turkey, the pinnated grouse or heath hen, the ruffed grouse or partridge, the bobwhite or quail and the woodcock, which spends a part of the year on the uplands and for convenience may be classed with the others. All of these birds were very plentiful. Under a policy of unrestricted shooting the wild turkeys finally disappeared, and the heath hens, which were at first very numerous, even on the site of Boston, were so reduced in numbers that Dr. Dwight published the statement in 1821 that they were no longer common, and Sylvester Judd gives testimony in the "History of Hadley" to the effect that they probably disappeared from the region near Springfield about 1813. In 1831 they had become so rare in the State that a special act was passed protecting them during the breeding season, or from March 1 to September 1, under penalty of a two-dollar fine. This partial remedy proved entirely ineffective, and the grouse were soon destroyed and driven out until Cape Cod became their last stronghold on the mainland of Massachusetts. These birds were now disappearing throughout their range in the Atlantic coast States, and in 1837, after they had vanished from the mainland, a special statute was passed, establishing a close season for the heath hen for four years, with a penalty of $10 and a forfeit of $10 to the landowner. This was extended five years more in 1841 and in 1844 the fine was increased to $20 in addition to the $10 forfeit to the landowner, and the possession or sale of the birds was forbidden. All these provisions, too late to be effective, were of no avail, except to protect the few left on Martha's Vineyard.

In 1855 all protection was removed from this bird; still for five years the last remnant of the race persisted, unprotected, in the wild and bushy interior of Martha's Vineyard, where they were not much molested. In 1860 they were again protected by law at all times, under a penalty of $20, but in 1870 the date of such protection was fixed at a period of six years. Since that time the remnant of the species has managed to exist on the island. They are now guarded and protected at all times, as the Commissioners on Fisheries and Game are empowered to give them special care, that this valuable game species may be propagated and increased in numbers.

The ruffed grouse or partridge, the bobwhite or quail and the woodcock had no protection in Massachusetts at any time until 1818, when the close season was established on the first two birds, beginning March 1 and ending September 1, and woodcock were protected from March 1 to July 4. Since then all these birds have been shielded by law at some season, but during the latter half of the nineteenth century there was a periodical fight between the forces of protection and those of destruction, which resulted in frequent changes of the statutes, so that at one time or another during this period the close season either began or ended in each of the fall and winter months, while the beginning of the open season fluctuated similarly through most of the summer and fall months. The quail suffers much from hard winters, and no law can protect it; but shooting should be prohibited for at least two years after each such winter.

A great volume of legislation has been enacted in regard to the ruffed grouse. The tendency has been to improve the bird's chances, and now with an open season of only two months, and with snaring and sale of grouse and woodcock prohibited, these birds have a fair chance to perpetuate their species. Both the grouse and quail, however, are now menaced by contagious diseases which are likely to be introduced among them by chickens or turkeys and possibly by pheasants.[1]

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[1] See the annual report of the Massachusetts Commissioners on Fisheries and Game for 1906.

The woodcock fared worst in the ups and downs of oscillating legislation, and by 1850 summer shooting had decimated the breeding birds in some localities, and it was prohibited for a while; but even as late as 1889 woodcock could be legally shot in August in this enlightened Commonwealth. At last, after more experimenting, the open season was reduced in 1900 to two months (October and November), and the woodcock now appears to be holding its own in some localities.

### Pigeons and Doves.

The extraordinary abundance of the wild or passenger pigeon in this country is said to have exceeded that of any other bird in this or any other land. Early settlers of Massachusetts asserted that the passing flocks covered the whole sky for hours at a time, darkening the sun and subduing the light of day, and that but a few leagues from where Boston now stands the nests of the pigeons covered the trees of the pine forest for miles. The multitude of these birds was so prodigious, and they roamed so widely over the continent, that it became the general belief that they needed no protection, and that their extermination was impossible.

The first legislation regarding them was chapter 85 of the Acts of 1848, which was framed to protect the pigeon netters from interference, and imposed a penalty of $10 beside actual damages on any one who should be convicted of the heinous offense of frightening pigeons away from the nets. In 1849 this penalty was increased to $20, or imprisonment for not more than thirty days. Thus the pigeon was denied protection, while its greatest enemies, the netters, were safeguarded in their business. The parent birds were trapped and shot at their nesting places, and the young left to starve, or clubbed out of the nests and killed for food. Even the swarming millions of the pigeons could not withstand slaughter at all seasons. Their numbers in Massachusetts rapidly grew less. Nevertheless, we find no protection whatever accorded them until 1879, when as they were rapidly nearing extinction a law was passed protecting them on their breeding grounds; but even then the netter or hunter could trap or shoot them coming or going to or from their nests. At this time, however, the pigeons had been practically driven out of the State, and only a few were occasionally seen in the migrations; but our people were not awake to the fact that the extermination of the pigeons was very near. Finally, in 1886, when the species was nearly extinct in the State, a law was passed establishing a general close season. The last authentic record of a wild pigeon nesting in this State is given by Howe and Allen as in 1889. In 1901 the Legislature prohibited the killing of pigeons for all time. Comment is unnecessary. The last bird I have seen recorded as killed in either the United States or Canada was taken near Babcock, Wis., in September, 1900.[1] Reports occasionally are received of the appearance of pigeons in some part of the country, and possibly there may be a few left; but naturalists are offering large rewards for specimens, and thus far not a single bird has been secured. Probably the birds seen are mourning doves.

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[1] Mershon, W. B. "The Passenger Pigeon," p. 223. New York, 1907.

These doves, like the pigeons, once roamed over a large part of the continent, but never congregated in such large flocks, and, unlike the pigeon, they soon become gun-shy wherever they are hunted, although very tame where protected. They have thus escaped the fate of the pigeons, and a few are still found breeding in Massachusetts, while small flocks may be seen occasionally in the fall. They resemble the wild pigeon, except for their smaller size, and are often mistaken for it. There seems to have been no attempt to protect them until 1879, when they were presumably included in chapter 209 among the "other undomesticated birds, except birds of prey," etc., not to be killed at any time. This, however, gave them scarcely any immunity, as they were mistaken for wild pigeons, and are still shot by some gunners when opportunity offers, notwithstanding the fact that a provision inserted in chapter 414, Acts of 1905, specifically protects them at all times.

### NON-GAME BIRDS.

The Indians did not kill small birds, nor did the settlers disturb them. So long as deer, turkey, grouse, wild fowl and shore birds were abundant the smaller game birds, the herons and other fish eaters, and the song birds were safe from any considerable molestation by man. But in the first half of the nineteenth century, when the larger game grew rare, gunners and boys began shooting woodcock, snipe, robins and larks, and the act of 1818 was found necessary to protect these birds in the breeding season. From that time complaints appeared periodically in the press regarding the conduct of boys who shot small birds. As the population increases, this evil becomes more serious. Within the past twenty years immigrants from Italy have become very destructive to song birds. Until recent years there has been no provision protecting the eggs of birds. The gunners and eggers had driven away most of the sea birds from their breeding places along the coast, and the business of procuring the eggs of birds for collectors had assumed considerable proportions. Finally, in 1869, the taking or killing of all undomesticated birds not otherwise protected, except snipe, hawks, owls, crows, jays and gulls, and the taking of birds' eggs, except those of the birds above mentioned, was prohibited; but a proviso was inserted allowing the killing of birds or the taking of eggs under permit for scientific purposes. This tended to limit the work of the professional egg collector, but it failed to protect the gulls and terns, the plumage of which was eagerly sought by the milliners. Many thousands of these birds were killed on their breeding grounds and the young left to starve.

At last, in 1879, when the diminution of these birds had become painfully evident, partial protection was given the birds by establishing a close season between May 1 and September 1. In 1881 the season was shortened. In 1886 it was extended, and so on.

Finally, in 1901, the smaller gulls and the terns were protected by law at all times. The terns of Massachusetts undoubtedly would have been exterminated long before that time but for the efforts of Mr. Geo. H. Mackay and his associates in securing protection for them on their breeding grounds on Muskeeget and Penikese islands. In the meantime, the least tern or sea swallow was nearly extirpated from Massachusetts. An open season on the larger gulls was maintained until 1907, although every other Atlantic coast State which they inhabit had previously given them protection at all times.

Herons and bitterns never had any specific statutory protection in this State until 1903, when the great blue heron had been virtually driven out of the State as a breeder, and was rarely seen except during its migrations, and the smaller herons had been greatly reduced in numbers and most of their heronries broken up. It is now unlawful to kill them at any time, except when in the act of catching trout artificially confined. Already night herons are increasing in some localities, owing to the beneficial effects of protection.

Hawks and owls never had any protection in this State until the year 1907. Most species have decreased very rapidly. Now all the most useful owls are protected at all seasons, and it is lawful to take or kill only the barred owl, the great horned owl and the sharp-shinned hawk, Cooper's hawk, goshawk, red-tailed hawk, red-shouldered hawk and duck hawk. Town bounties on the other species can no longer be legally paid or collected. All eagles and the osprey or fish hawk are likewise protected at all times.

In 1897 an act was passed providing a penalty of $10 for the offense of having in possession the body or feathers of any undomesticated bird then protected at all times by chapter 276 of the statutes of 1886. This statute also prohibited the wearing of such feathers for dress or ornament. It was aimed at the milliners who provided the feathers and their patrons who wore them, and has largely broken up the traffic in the feathers of native birds that are protected at all seasons. In 1902 the traffic in native song birds for cage purposes had grown so destructive that a special penalty of $10 was provided for capturing or possessing any bird protected by law throughout the year.

In the meantime, the shooting of small birds by foreigners about cities and near construction camps of laborers had become so serious an evil that a law was passed (chapter 317, Acts of 1905) requiring all unnaturalized foreign-born hunters to pay a license fee of $15 for a license giving them the privilege of hunting. This law has checked somewhat the destruction of birds and game by Italians and other foreigners.

### General Bird Laws.

One of the most important statutes for the general protection of birds and game was passed in 1899, making "the Lord's Day" a close season, and imposing on the lawbreaker the penalties incurred by breaking the game laws in addition to those usually inflicted for infractions of the "Sunday laws." This statute was revised in 1902, and in 1904 it was made still more effective and severe by providing a penalty of $10 to $20 in addition to usual fines for hunting or killing game in close season.

The Legislature of 1907 passed a law requiring all non-resident hunters, except those who were members of shooting clubs already incorporated and established in the State, to pay a license of $10 for the privilege of hunting in the State. This is a good law with the exception of the exemption.

### Fines and Forfeitures.

Beginning in 1818, with a fine of $1 or $2 for the killing of each bird in defiance of the law, penalties have been increased or decreased from year to year. The general tendency, however, has been to increase the fines. The maximum of $100 per bird has been reached in the case of the heath hen. The foreigner or non-resident who hunts without a license may be fined $50. The same fine may be required of any person who kills a wood duck or from any one who uses a live decoy for black ducks in Nantucket. In general, a fine of $20 is imposed for each game bird killed out of season, but $10 only is required in the case of each shore bird, and the same amount in that of each other undomesticated bird or each nest or egg of such bird as is protected at all times.

### The Enforcement of the Bird Laws.

Until the year 1886 our game laws were rather ineffective, for there was no one who considered it his duty to enforce them. In 1886 the Commissioners of Inland Fisheries were given by law the powers of game commissioners. This was the most important step taken for the protection of birds and game up to that time, for it assured, in some measure, at least, the enforcement of the law. The powers and duties of the commissioners have been extended from time to time, and their efficiency has been increased.

In 1894 a resolve was enacted providing for the introduction of Mongolian pheasants. The species introduced was the ring-neck. In 1895 the commissioners were authorized to propagate birds and animals, and the sum of $500 was appropriated for the purpose of purchasing and propagating pheasants. While the introduction of the pheasants may not have been an unmixed blessing, the experience gained in propagating birds will be of value to the Commonwealth, for unquestionably the time has come for Massachusetts to experiment, with a view of eventually propagating and distributing native game birds to supply her depleted covers.

### NEEDED LEGISLATION.

This necessarily limited and imperfect review of our legislative enactments for the conservation of birds exhibits clearly the main reasons why protection has, in many cases, failed to protect. The principal reasons for this failure are four in number: (1) legislation has been spasmodic and vacillating, (2) laws and penalties have not been sufficiently stringent, (3) until recent years the laws have not been enforced, (4) *protection has come too late.*

Protection will always be ineffective if it is held back until the need for it is generally recognized. It should become operative before it becomes necessary to save a bird from extermination. Its laws should not be enacted merely with the purpose of maintaining the present number of birds. Its province should be to *increase their numbers* before they are in any danger of extinction, and legislation with this end in view *is needed now.*

In 1904 it was stated in my report on the decrease of birds [1] that at least six species of game birds, waterfowl or shore birds had disappeared, and that the passenger pigeon was then practically gone from Massachusetts, and also that several other species were then nearly extirpated or driven out. Among these latter the Eskimo curlew was mentioned. To-day the belief obtains among ornithologists that both the passenger pigeon and the Eskimo curlew are extinct. It may be already too late to save the vanishing species, and the wood duck and the upland plover are in great danger.

The question arises, What more can be done to conserve and increase the birds that remain?

### FIRST, WE MUST STOP ALL SPRING AND SUMMER SHOOTING.

Evidently it is most important to allow all birds to breed unmolested. Bobolinks, blackbirds and robins which are protected on their northern breeding grounds maintain their numbers well, though slain in great numbers during the migrations in the south. If the people of New England are not to lose their supply of pond and river ducks, these ducks must be protected throughout the spring migrations and during the breeding season in these States as well as in Canada. Experience shows that in those months when the shooting of any species is allowed all edible ducks will be shot. Let the shooting of all wild fowl stop with the first day of January; let our rivers, shores and bays be free from shooting from January first to September first, and in time wood duck, black duck, teal, loons, Canada geese and other species may come back to our streams, ponds and shores, and breed as they did long ago. Teal once bred as far south as Long Island. Canada geese nested in this State, and even as far south as New Mexico. Now they have been driven north, beyond the borders of the United States.

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[1] Forbush, Edward Howe, "Special Report on the Decrease of Certain Birds and its Causes, with Suggestions for Bird Protection." Fifty-second report of the Massachusetts State Board of Agriculture.

The mere presence of man disturbs the birds very little, where no shooting is allowed. This has been proved in many cases where the wildest of wild fowl have become very tame in localities where they were unmolested. Since spring duck shooting was stopped by law in New York State the black ducks have bred in considerable numbers on Fisher's Island. New York and Connecticut have already passed laws which establish the beginning of the close season for wild ducks on January 1. New Hampshire takes February 1 as her date, except in one county, and a considerable number of other States and provinces of North America are already in advance of Massachusetts in this matter.

A law should be enacted here forbidding the taking or killing of all wild fowl and shore birds between the first day of January and the first day of September, in order that the birds may be absolutely undisturbed during that season and that some of them may breed here unmolested. Wherever such a law has been passed and enforced in a single State the effect has been beneficial almost immediately, and the birds which have been driven out have come back, bred and increased rapidly.

### A Resident Hunting License.

A law requiring a one-dollar license fee of all resident hunters is now an absolute necessity. Unless such a law is passed the non-resident license law will remain a dead letter, for unless all hunters are licensed it is difficult, if not impossible, for the officers in the field to identify non-residents of the State. A resident license law, which gives to the hunter no privilege he does not now possess and gives to the landowner the right to examine the licenses of all hunters who are found upon his land, would furnish money for the protection and propagation of game, and would largely do away with a class of irresponsible trespassing hunters that is now a source of much irritation and injury to the farming population. Such laws are not experiments. They originated in the agricultural States of the middle west, and have given good results in the protection of birds and game and the safeguarding of rural property.[1]

### Prohibit the Sale of Game Birds.

How much longer can our game birds be expected to survive with a price set upon their heads? If a man should attempt to cut down a great tree by snipping off the little twigs with scissors, he would be advised to begin with the axe at the root. In the attempt to protect our game birds we have been clipping away at the twigs too long. Let us now take up the axe. The laws which have been passed regulating the sale and transportation of game are useful under present conditions, but there is one statutory provision alone which will strike at the root of the evil and check the slaughter of game birds by taking away the incentive for pothunting; and that is the prohibition of the sale of all game birds.

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[1] Since the above was written, a law requiring the registration of all resident hunters has passed the Legislature. It becomes operative Jan. 1, 1909.

It would be for the interest of the marketman were this enacted, for he is now constantly hampered by restrictions and harassed by legal requirements. It would not, in the end, injure his business, for he would then sell turkeys, chickens, geese, ducks, pigeons, squabs, guineas and possibly pheasants in place of the game he now sells. Such a law would be better for the farmer and poultry raiser, who would be called upon to supply more domesticated birds to take the place of the wild ones now sold. It would be better for the sportsman, who sees himself prohibited from shooting certain wild fowl and other migrating game birds here in certain months only to have them shot by market gunners in other States and sold in our own as well as other markets. Such a law would injure no one except the man who pursues birds for a living, — the man who kills the goose that lays the golden egg, — the man who exterminates the birds. The time is gone by in Massachusetts and in the east when any man should be allowed to live by the killing of birds and game. This should be stopped, for the benefit of the whole people. We should no longer be allowed to exterminate, and thus deprive posterity of its birthright in the birds and game.[1]

The market hunter or pothunter is often a good and worthy citizen, but his day is past and he must adopt some other calling. More than forty States now prohibit the sale of all or a part of their game. Massachusetts should have been among the leaders in this movement.

Next in importance to the elimination of the market hunter comes the bag limit. Some so-called sportsmen are nearly as destructive as the market hunter, but many who now kill so long as their ammunition lasts would respect a legal limit to the number of birds to be killed in a day or in a season.

### Right of Search.

The Commissioners on Fisheries and Game and their deputies should be given the power to search without a warrant. This power can be exercised without abuse as it now is in other States. There can be little hope of thorough enforcement of the law until the officers who enforce it have this power.[2]

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[1] If at any time the artificial propagation of game birds becomes successfully established as an industry, the sale of certain species that can be artificially reared in great numbers may be allowed.

[2] Since the above was written a law has been passed which gives the game officers the right to arrest without a warrant any hunter who fails to exhibit his game on demand.

## THE SANCTUARY.

Where all other measures promise only failure there is still one resource left, and that is the setting aside of tracts or reservations of woodland, lake, river or shore within the limits of which all killing of birds by man may be prohibited, under heavy penalties. In such tracts or reservations the resident game and birds may breed unmolested, and thus replenish the surrounding country. Here migrants can find safety to stop and rest from their long journeys.

A chain of such sanctuaries established along the Atlantic coast of North America would probably preserve our stock of wild fowl and shore birds indefinitely. The sanctuary has succeeded in Europe, and it is no new idea here. Already in Massachusetts we have been experimenting with it in a small way. One modification of the plan is to forbid the taking or killing of all wild animals or all birds within certain limits, after the plan adopted on Cape Ann in 1897 and in the town of Essex in 1899. In these cases a time limit of five years was set; but such an act might be made perpetual. Park commissioners are given police powers, and can prevent shooting within the limits of their reservations, as the Metropolitan Park Commission and many city park commissioners now do. In 1899 3,000 acres of land were set aside on Wachusett Mountain as a State reservation, and the commissioners in charge were given police powers; this should ensure a permanent game sanctuary for Worcester County. The enactment in 1907, by which the Commissioners on Fisheries and Game were empowered to take 1,000 acres of land on Martha's Vineyard as a reservation for the protection of the heath hen and other birds, is an example of direct legislation for this purpose, more of which will, sooner or later, become necessary.

While efforts should not be relaxed to secure beneficent protective legislation, the most important work that can be done by the bird protectionist is to strive to influence public sentiment regarding the necessity for such enactments, for laws can never be fully enforced until they are respected by the people.

# FINANCIAL RETURNS

AND

# ANALYSIS OF PREMIUMS AND GRATUITIES

OF THE

# INCORPORATED SOCIETIES,

WITH

## MEMBERSHIP AND INSTITUTES,

For the Year 1907.

### FINANCIAL RETURNS OF THE INCORPORATED

| | SOCIETIES. | When incorporated. | Amount originally raised by Contribution. (R. L. 124, Sects. 1 and 3.) | Amount now held invested as Capital Stock. (R. L. 124, Sects. 3 and 12.) | Estimated Market Value of Property. | Total Assets. |
|---|---|---|---|---|---|---|
| 1 | Amesbury and Salisbury (Agricultural and Horticultural), . | 1881 | $1,002 32 | [1] $8,121 97 | $8,121 97 | $8,121 97 |
| 2 | Barnstable County, . . . . | 1844 | 1,740 00 | [2] 9,875 00 | 9,875 00 | 10,068 57 |
| 3 | Blackstone Valley, . . . . | 1884 | 3,000 00 | [3] 4,400 00 | 4,400 00 | 4,437 67 |
| 4 | Bristol County Fair, Incorporated, | 1907 | 15,000 00 | [3] 30,000 00 | 32,368 96 | 32,477 96 |
| 5 | Deerfield Valley, . . . . | 1871 | 4,094 01 | [3] 9,200 00 | 9,450 00 | 9,656 05 |
| 6 | Eastern Hampden, . . . . | 1856 | 3,000 00 | [3] 7,000 00 | 7,000 00 | 7,110 22 |
| 7 | Essex, . . . . . . . | 1818 | 4,527 20 | [4] 17,515 04 | 17,515 04 | 17,515 04 |
| 8 | Franklin County, . . . . | 1850 | 3,768 00 | [5] 11,000 00 | 11,068 46 | 11,068 46 |
| 9 | Hampshire, . . . . . . | 1850 | 3,255 26 | [1] 5,150 00 | 5,150 00 | 5,170 51 |
| 10 | Hampshire, Franklin and Hampden, . . . . . . . | 1818 | 8,141 29 | [4] 13,354 72 | 13,354 72 | 13,354 72 |
| 11 | Highland, . . . . . . | 1859 | 3,262 00 | [1] 3,120 00 | 3,120 00 | 3,163 63 |
| 12 | Hillside, . . . . . . . | 1883 | 3,113 32 | [4] 6,250 56 | 6,250 66 | 6,258 59 |
| 13 | Hingham (Agricultural and Horticultural), . . . . . . | 1867 | 17,406 15 | [6] 4,914 09 | 4,914 09 | 4,914 09 |
| 14 | Hoosac Valley, . . . . . | 1860 | 2,006 00 | [1] 16,500 00 | 16,500 00 | 17,659 16 |
| 15 | Housatonic, . . . . . . | 1848 | 6,335 33 | [6] 25,204 61 | 25,204 61 | 25,204 61 |
| 16 | Marshfield (Agricultural and Horticultural), . . . . . . | 1867 | 3,755 33 | [1] 14,500 00 | 14,500 00 | 14,500 00 |
| 17 | Martha's Vineyard, . . . . | 1859 | 4,552 17 | [4] 4,353 09 | 4,353 09 | 4,604 22 |
| 18 | Massachusetts Horticultural, . | 1829 | 525 00 | [7] 564,524 70 | 815,849 96 | 823,544 76 |
| 19 | Massachusetts Society for Promoting Agriculture,[8] . . . | 1792 | – | – | – | – |
| 20 | Middlesex North, . . . . | 1855 | 3,000 00 | [9] 7,279 00 | 7,179 00 | 7,279 00 |
| 21 | Middlesex South, . . . . | 1854 | 3,000 00 | [3] 12,000 00 | 12,200 00 | 12,305 20 |
| 22 | Nantucket, . . . . . . | 1856 | 3,500 00 | [3] 3,200 00 | 3,200 00 | 3,226 73 |
| 23 | Oxford, . . . . . . . | 1888 | 4,400 00 | [4] 10,059 13 | 10,059 13 | 10,059 13 |
| 24 | Plymouth County, . . . . | 1819 | 9,550 00 | [10] 1,668 31 | 1,653 06 | 1,668 31 |
| 25 | Spencer (Farmers' and Mechanics' Association), . . . . . | 1888 | 4,034 00 | [1] 10,350 00 | 10,350 00 | 10,384 01 |
| 26 | Union (Agricultural and Horticultural), . . . . . . | 1867 | 4,447 23 | [1] 9,000 00 | 9,000 00 | 9,037 12 |
| 27 | Weymouth (Agricultural and Industrial), . . . . . . | 1891 | 10,270 00 | [1] 11,270 00 | 11,270 00 | 11,376 01 |
| 28 | Worcester, . . . . . . | 1818 | 7,730 00 | [4] 85,141 12 | 85,141 12 | 85,141 12 |
| 29 | Worcester East, . . . . . | 1890 | 2,296 23 | [11] 10,428 00 | 10,428 00 | 10,428 00 |
| 30 | Worcester Northwest (Agricultural and Mechanical), . . | 1867 | 3,400 00 | [1] 13,300 00 | 13,300 00 | 13,513 25 |
| 31 | Worcester South, . . . . | 1855 | 3,127 40 | [1] 11,400 00 | 11,400 00 | 11,641 39 |
| 32 | Worcester County West, . . | 1851 | 3,175 00 | [1] 14,000 00 | 14,000 00 | 14,516 58 |
| | | | $150,413 24 | $954,079 34 | $1,208,176 77 | $1,219,406 08 |

[1] Invested in real estate, crockery, tables, etc.

[2] Invested in real estate, bonds and bank funds.

[3] Invested in real estate.

[4] Invested in real estate, bank funds, crockery, tables, etc.

[5] Invested in real estate and stocks.

[6] Invested in real estate, bank funds, cash, crockery, tables, etc.

SOCIETIES FOR THE YEAR ENDING DEC. 31, 1907.

| Real Estate. | Notes. | Stocks and Bonds. | Bank Funds. | Bills due and unpaid. | Crockery, Tables, etc. | Cash on Hand. | Total Liabilities. | |
|---|---|---|---|---|---|---|---|---|
| $7,716 69 | – | – | – | – | $405 28 | – | $1,714 43 | 1 |
| 8,000 00 | – | $500 00 | $1,375 00 | $68 00 | – | $125 57 | 1,149 50 | 2 |
| 4,400 00 | – | – | – | – | – | 37 67 | 1,923 00 | 3 |
| 30,000 00 | – | 300 00 | 1,068 96 | 109 00 | 100 00 | – | 20,848 33 | 4 |
| 9,200 00 | – | – | – | – | 250 00 | 206 05 | – | 5 |
| 7,000 00 | – | – | – | – | – | 110 22 | 6,514 13 | 6 |
| 15,300 00 | – | 1,920 00 | – | – | 200 00 | 95 04 | 7,000 00 | 7 |
| 10,000 00 | – | 1,000 00 | – | – | – | 68 46 | 4,700 00 | 8 |
| 5,000 00 | – | – | 18 51 | – | 150 00 | 2 00 | 2,075 00 | 9 |
| 12,300 00 | – | – | 554 72 | – | 500 00 | – | 3,000 00 | 10 |
| 3,000 00 | – | – | – | – | 120 00 | 43 63 | – | 11 |
| 5,000 09 | – | – | 500 00 | – | 350 00 | 408 59 | – | 12 |
| 2,500 00 | – | – | 1,376 65 | – | 1,000 00 | 37 44 | – | 13 |
| 16,000 00 | – | – | – | – | 500 00 | 1,159 16 | 9,000 00 | 14 |
| 22,000 00 | – | 500 00 | 697 36 | – | 425 00 | 1,582 25 | 2,035 00 | 15 |
| 14,000 00 | – | – | – | – | 500 00 | – | 2,246 38 | 16 |
| 2,750 00 | $150 00 | – | 1,203 09 | 10 00 | 250 00 | 241 13 | 18 00 | 17 |
| 563,168 16 | – | 242,510 00 | – | – | 10,171 80 | 7,694 80 | 5,500 00 | 18 |
| – | – | – | – | – | – | – | – | 19 |
| – | 5,300 00 | – | 1,879 00 | – | – | 100 00 | – | 20 |
| 12,000 00 | – | – | – | 10 00 | 200 00 | 95 20 | 7,800 00 | 21 |
| 3,200 00 | – | – | – | – | – | 26 73 | 597 74 | 22 |
| 9,700 00 | – | – | 159 13 | – | 200 00 | – | – | 23 |
| – | – | – | 1,614 06 | – | 39 00 | 15 25 | 16 90 | 24 |
| 9,400 00 | – | – | – | – | 950 00 | 34 01 | 1,850 00 | 25 |
| 8,000 00 | – | – | – | – | 1,000 00 | 37 12 | 1,308 75 | 26 |
| 11,000 00 | – | – | – | 100 00 | 270 00 | 6 01 | 3,174 00 | 27 |
| 59,681 17 | – | – | 23,521 59 | – | 1,938 36 | – | – | 28 |
| 9,409 09 | – | – | – | – | 50 00 | 968 91 | 134 45 | 29 |
| 13,000 00 | – | – | 213 25 | – | 300 00 | – | 4,650 00 | 30 |
| 11,100 00 | – | – | – | – | 300 00 | 241 39 | 1,170 40 | 31 |
| 13,000 00 | – | – | – | 193 65 | 1,000 00 | 22 93 | 700 00 | 32 |
| $896,825 11 | $5,450 00 | $246,730 00 | $34,181 32 | $490 65 | $22,069 44 | $13,359 56 | $89,126 01 | |

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[7] Invested in real estate, library, furniture, bonds and other securities.

[8] Represented on the Board by special enactment, and makes no returns.

[9] Invested in notes, bank funds and cash.

[10] Invested in bank funds, cash, crockery, tables, etc.

[11] Invested in real estate, cash, crockery, tables, etc.

## FINANCIAL RETURNS OF THE INCORPORATED SOCIETIES

| | SOCIETIES. | Premiums due and unpaid. | Outstanding Bills. | Mortgages or Like Liabilities. | Total Receipts. | Bounty. | Income from Notes and Bank Funds. |
|---|---|---|---|---|---|---|---|
| 1 | Amesbury and Salisbury (Agricultural and Horticultural), | – | $214 43 | $1,500 00 | $2,878 85 | $596 05 | – |
| 2 | Barnstable County, | $164 50 | 185 00 | 800 00 | 8,744 60 | 600 00 | $42 00 |
| 3 | Blackstone Valley, | – | 13 00 | 1,910 00 | 1,537 62 | 429 09 | – |
| 4 | Bristol County Fair, Incorporated, | 177 40 | 668 43 | 20,002 50 | 18,683 31 | – | – |
| 5 | Deerfield Valley, | – | – | – | 2,315 09 | 600 00 | – |
| 6 | Eastern Hampden, | – | 324 13 | 6,190 00 | 5,337 01 | 600 00 | – |
| 7 | Essex, | – | – | 7,000 00 | 15,755 22 | 600 00 | 3 65 |
| 8 | Franklin County, | – | – | 4,700 00 | 8,319 04 | 600 00 | – |
| 9 | Hampshire, | – | – | 2,075 00 | 1,536 15 | 600 00 | – |
| 10 | Hampshire, Franklin and Hampden, | – | 200 00 | 2,800 00 | 7,865 88 | 600 00 | 21 30 |
| 11 | Highland, | – | – | – | 1,721 33 | 600 00 | – |
| 12 | Hillside, | – | – | – | 1,763 30 | 600 00 | – |
| 13 | Hingham (Agricultural and Horticultural), | – | – | – | 810 62 | 596 65 | 45 47 |
| 14 | Hoosac Valley, | – | – | 9,000 00 | 4,847 72 | 600 00 | – |
| 15 | Housatonic, | – | 35 00 | 2,000 00 | 12,702 92 | 600 00 | 12 07 |
| 16 | Marshfield (Agricultural and Horticultural), | 25 40 | 114 89 | 2,106 09 | 6,657 55 | 600 00 | – |
| 17 | Martha's Vineyard, | 6 00 | 12 00 | – | 1,424 55 | 600 00 | 57 78 |
| 18 | Massachusetts Horticultural, | [1] 5,500 00 | – | – | 20,198 91 | 600 00 | – |
| 19 | Massachusetts Society for Promoting Agriculture,[3] | – | – | – | – | – | – |
| 20 | Middlesex North, | – | – | – | 205 48 | – | 168 00 |
| 21 | Middlesex South, | – | – | 7,800 00 | 2,155 66 | 600 00 | – |
| 22 | Nantucket, | – | 25 50 | 572 24 | 1,194 50 | 600 00 | – |
| 23 | Oxford, | – | – | – | 4,609 27 | 600 00 | 36 40 |
| 24 | Plymouth County, | – | 16 90 | – | 438 44 | 299 75 | 28 00 |
| 25 | Spencer (Farmers' and Mechanics' Association), | – | 50 00 | 1,800 00 | 3,788 97 | 600 00 | – |
| 26 | Union (Agricultural and Horticultural), | 8 75 | – | 1,300 00 | 2,301 65 | 600 00 | – |
| 27 | Weymouth (Agricultural and Industrial), | – | 150 00 | 3,024 00 | 4,323 04 | 600 00 | 89 02 |
| 28 | Worcester, | – | – | – | 9,819 88 | 600 00 | 1,030 80 |
| 29 | Worcester East, | – | 134 45 | – | 9,390 40 | 600 00 | 59 59 |
| 30 | Worcester Northwest (Agricultural and Mechanical), | – | – | 4,650 00 | 7,653 66 | 600 00 | – |
| 31 | Worcester South, | 75 40 | 95 00 | 1,000 00 | 6,713 48 | 600 00 | – |
| 32 | Worcester County West, | – | – | 700 00 | 4,195 90 | 600 00 | – |
| | | $5,957 45 | $2,238 73 | $80,929 83 | $179,890 00 | $16,921 54 | $1,594 54 |

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[1] Awarded in 1907; to be paid in 1908.

[2] Awarded in 1906.

FOR THE YEAR ENDING DEC. 31, 1907 — *Concluded.*

| Income from Stocks and Bonds. | Received from New Members. | Received as Donations. | Received from All Other Sources. | Total Expenditures. | Premiums and Gratuities paid. | Current Running Expenses. | Interest. | All Other Expenses. | |
|---|---|---|---|---|---|---|---|---|---|
| – | $6 00 | $24 05 | $2,252 75 | $2,878 85 | $657 05 | $1,715 99 | $87 50 | $418 31 | 1 |
| $20 00 | 120 00 | 415 00 | 7,547 60 | 8,619 03 | 2,600 95 | 2,779 43 | 40 00 | 3,198 65 | 2 |
| – | 27 00 | 44 80 | 1,036 73 | 1,499 95 | 622 80 | 752 15 | 65 00 | 60 00 | 3 |
| – | 300 00 | – | 18,383 31 | 17,614 35 | 1,027 15 | 1,045 27 | 702 08 | 14,839 85 | 4 |
| – | 57 00 | 2 25 | 1,655 84 | 2,109 04 | 1,171 60 | 937 44 | – | – | 5 |
| – | 20 00 | – | 4,717 01 | 5,226 79 | 727 05 | 2,233 81 | 270 53 | 1,995 40 | 6 |
| 48 00 | 36 00 | – | 15,067 57 | 15,425 90 | 1,880 75 | 702 07 | 488 58 | 12,354 50 | 7 |
| 40 00 | 1 00 | 193 00 | 7,485 04 | 7,650 58 | 2,499 85 | 3,751 20 | 294 63 | 1,104 90 | 8 |
| – | 7 50 | 130 65 | 798 00 | 1,515 64 | 611 01 | 783 83 | 120 80 | – | 9 |
| – | 119 00 | – | 7,125 58 | 8,523 12 | 1,130 45 | 1,373 13 | 166 41 | 5,853 13 | 10 |
| – | 29 00 | 36 50 | 1,055 83 | 1,677 70 | 600 50 | 1,039 50 | 4 20 | 33 50 | 11 |
| – | – | – | 1,163 30 | 1,275 80 | 716 25 | 559 55 | – | – | 12 |
| – | 1 00 | 5 50 | 162 00 | 897 32 | 606 75 | 271 32 | – | – | 13 |
| – | – | – | 4,247 72 | 3,688 56 | 727 25 | – | 475 00 | 2,486 31 | 14 |
| 30 00 | 452 00 | – | 11,608 85 | 11,610 00 | 5,512 25 | 5,059 58 | 100 00 | 938 17 | 15 |
| – | 170 00 | 348 00 | 5,539 55 | 6,772 44 | 2,056 30 | 4,574 67 | 141 47 | – | 16 |
| – | – | – | 766 77 | 1,101 85 | 617 73 | 369 21 | – | 114 91 | 17 |
| 10,900 00 | 960 46 | – | 7,738 45 | 21,522 77 | [2] 5,838 21 | 15,374 16 | – | 310 40 | 18 |
| – | – | – | – | – | – | – | – | – | 19 |
| – | – | – | 37 48 | 1,004 20 | 548 75 | 198 00 | – | 257 45 | 20 |
| – | 56 62 | – | 1,499 04 | 2,060 46 | 1,140 15 | 608 22 | – | 312 09 | 21 |
| – | 13 00 | 14 00 | 567 50 | 1,167 72 | 620 50 | 547 22 | – | – | 22 |
| – | 44 00 | 32 25 | 3,896 62 | 4,450 14 | 1,438 89 | 1,316 63 | – | 1,694 62 | 23 |
| – | – | 16 00 | 94 69 | 446 49 | 302 00 | 144 49 | – | – | 24 |
| – | 5 00 | 67 50 | 3,1[illegible] 47 | 3,149 96 | 1,754 52 | 1,395 44 | – | – | 25 |
| – | 29 00 | 10 00 | 1,662 65 | 2,264 53 | 1,088 36 | 986 28 | 2 50 | 187 39 | 26 |
| – | 50 00 | 9 40 | 3,574 62 | 4,317 03 | 610 25 | 3,560 78 | 146 00 | – | 27 |
| – | 110 00 | 331 40 | 7,747 68 | 17,208 29 | 3,322 07 | 2,079 72 | – | 11,806 50 | 28 |
| – | 18 00 | 350 00 | 8,362 81 | 8,572 55 | 1,681 60 | 6,082 37 | – | 808 58 | 29 |
| – | – | 574 50 | 6,479 16 | 7,440 41 | 2,476 79 | 2,979 96 | 237 00 | 1,746 66 | 30 |
| – | 50 00 | – | 6,063 48 | 6,316 84 | 1,994 00 | 3,306 24 | 80 00 | 936 60 | 31 |
| – | 190 00 | 105 00 | 3,300 90 | 4,238 28 | 2,098 75 | 2,099 29 | 40 24 | – | 32 |
| $11,038 00 | $2,871 58 | $2,709 80 | $144,755 00 | $182,246 59 | $48,680 53 | $68,626 95 | $3,461 94 | $61,477 17 | |

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[3] Represented on the Board by special enactment and makes no returns.

## ANALYSIS OF PREMIUMS AND GRATUITIES, MEMBERSHIP AND

| | SOCIETIES. | Total Amount offered in Premiums. | Total Amount awarded in Premiums and Gratuities. | Total Amount paid in Premiums and Gratuities. | Amount offered under Head of Farms, etc. | Amount awarded under Head of Farms, etc. | Amount paid under Head of Farms, etc. | Amount offered under Head of Farm and Pet Stock. |
|---|---|---|---|---|---|---|---|---|
| 1 | Amesbury and Salisbury (Agricultural and Horticultural), | $1,714 43 | $681 10 | $657 05 | – | – | – | [1] – |
| 2 | Barnstable County, | 3,368 75 | 2,765 45 | 2,600 95 | $146 00 | $14 00 | $14 00 | $637 00 |
| 3 | Blackstone Valley, | 1,049 40 | 654 80 | 622 80 | 135 00 | 57 00 | 50 00 | 716 50 |
| 4 | Bristol County Fair, Incorporated, | 2,402 75 | 1,204 55 | 1,027 15 | – | – | – | 1,761 00 |
| 5 | Deerfield Valley, | 1,550 70 | 1,171 60 | 1,171 60 | – | – | – | 894 00 |
| 6 | Eastern Hampden, | 1,059 10 | 727 05 | 727 05 | 116 00 | – | – | 699 00 |
| 7 | Essex, | 2,285 00 | 1,004 00 | [2] 1,880 75 | – | – | – | 1,244 00 |
| 8 | Franklin County, | 2,623 00 | 2,499 85 | 2,499 85 | – | – | – | 1,300 00 |
| 9 | Hampshire, | 1,424 00 | 728 50 | 611 01 | 25 00 | – | – | 792 00 |
| 10 | Hampshire, Franklin and Hampden, | 1,609 25 | 1,196 10 | 1,130 45 | 50 00 | – | – | 1,119 00 |
| 11 | Highland, | 740 65 | 600 50 | 600 50 | – | – | – | 479 00 |
| 12 | Hillside, | 900 00 | 722 35 | 716 25 | – | – | – | 510 00 |
| 13 | Hingham (Agricultural and Horticultural), | 1,435 55 | 606 75 | 606 75 | 71 75 | – | – | – |
| 14 | Hoosac Valley, | 1,200 00 | 727 25 | 727 25 | – | – | – | [1] – |
| 15 | Housatonic, | 6,165 25 | 5,512 25 | 5,512 25 | – | – | – | 1,543 00 |
| 16 | Marshfield (Agricultural and Horticultural), | 2,515 25 | 2,070 80 | 2,056 30 | 88 00 | – | – | 522 50 |
| 17 | Martha's Vineyard, | 970 00 | 643 14 | 617 73 | 18 00 | – | – | 442 00 |
| 18 | Massachusetts Horticultural, | 6,966 00 | 4,596 00 | [4] 5,838 21 | 432 00 | 366 00 | [4] 288 00 | – |
| 19 | Massachusetts Society for Promoting Agriculture,[3] | – | – | – | – | – | – | – |
| 20 | Middlesex North, | 760 00 | 573 90 | 548 75 | – | – | – | 200 00 |
| 21 | Middlesex South, | 1,820 00 | 1,215 10 | 1,140 15 | 75 00 | 20 00 | 20 00 | 788 00 |
| 22 | Nantucket, | 1,200 00 | 620 50 | 620 50 | 51 00 | 9 00 | 9 00 | 604 00 |
| 23 | Oxford, | 1,950 00 | 1,510 16 | 1,438 89 | 78 00 | 57 50 | 57 50 | 891 00 |
| 24 | Plymouth County, | 296 75 | 302 00 | 302 00 | – | – | – | – |
| 25 | Spencer (Farmers' and Mechanics' Association), | 2,263 00 | 1,777 25 | 1,754 52 | 75 00 | 45 00 | 45 00 | 1,125 00 |
| 26 | Union (Agricultural and Horticultural), | 1,601 30 | 1,113 35 | 1,088 36 | – | – | – | 785 50 |
| 27 | Weymouth (Agricultural and Industrial), | 1,151 40 | 613 85 | 610 25 | – | – | – | 679 00 |
| 28 | Worcester, | 4,134 50 | 3,322 07 | 3,322 07 | – | – | – | 3,024 50 |
| 29 | Worcester East, | 2,537 25 | 1,690 90 | 1,681 60 | 32 00 | 31 00 | 31 00 | 1,756 00 |
| 30 | Worcester Northwest (Agricultural and Mechanical), | 2,663 00 | 2,476 79 | 2,476 79 | – | – | – | [1] – |
| 31 | Worcester South, | 2,600 00 | 1,991 00 | 1,994 00 | 137 00 | 34 00 | 34 00 | 980 00 |
| 32 | Worcester County West, | 2,996 65 | 2,098 75 | 2,098 75 | 57 00 | 23 00 | 23 00 | 1,334 50 |
| | | $65,952 93 | $47,417 66 | $48,680 53 | $1,586 75 | $656 50 | $571 50 | $24,826 50 |

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[1] Not reported.

[2] Awarded in 1906 and 1907.

## Institutes, for the Year ending Dec. 31, 1907.

| Amount awarded under Head of Farm and Pet Stock. | Amount paid under Head of Farm and Pet Stock. | Amount offered under Head of Field and Garden Crops. | Amount awarded under Head of Field and Garden Crops. | Amount paid under Head of Field and Garden Crops. | Amount offered under Head of Farm and Garden Products. | Amount awarded under Head of Farm and Garden Products. | Amount paid under Head of Farm and Garden Products. | Amount offered under Head of Dairy Products. | Amount awarded under Head of Dairy Products. | |
|---|---|---|---|---|---|---|---|---|---|---|
| $226 50 | $226 50 | – | – | – | [1] – | $209 45 | $209 45 | [1] – | $3 25 | 1 |
| 506 25 | 410 00 | $141 00 | – | – | $379 00 | 305 50 | 275 50 | $11 00 | 5 00 | 2 |
| 453 75 | 453 75 | – | – | – | 115 40 | 74 05 | 74 05 | 10 00 | – | 3 |
| 719 00 | 582 50 | – | – | – | 194 75 | 178 00 | 174 50 | 25 00 | 6 00 | 4 |
| 572 55 | 570 30 | – | – | – | 77 00 | 62 10 | 62 10 | 12 00 | 12 00 | 5 |
| 473 75 | 473 75 | 64 50 | $53 50 | $53 50 | 55 75 | 142 75 | 142 75 | 32 00 | 22 00 | 6 |
| 431 50 | 326 50 | 196 00 | 7 00 | 7 00 | 500 00 | 346 50 | 249 75 | – | – | 7 |
| 1,252 00 | 1,252 00 | – | – | – | 300 00 | 251 00 | 251 00 | 26 00 | 9 00 | 8 |
| 275 00 | 242 05 | – | – | – | 177 50 | 105 00 | 95 00 | 13 00 | 3 00 | 9 |
| 881 75 | 841 75 | 101 00 | 6 00 | 6 00 | 174 50 | 168 25 | 165 25 | 36 00 | 12 00 | 10 |
| 389 45 | 389 45 | 26 50 | 13 00 | 13 00 | 65 00 | 43 85 | 43 85 | 5 00 | 5 00 | 11 |
| 436 10 | 436 10 | 45 00 | 31 50 | 31 50 | 85 00 | 67 40 | 67 40 | 7 00 | 3 75 | 12 |
| – | – | 166 00 | 28 00 | 28 00 | 864 55 | 449 55 | 449 55 | 3 50 | 3 00 | 13 |
| 420 75 | 420 75 | – | – | – | [1] – | 42 25 | 42 25 | [1] – | 6 00 | 14 |
| 1,091 50 | 1,091 50 | 214 00 | 207 00 | 207 00 | 312 00 | 277 75 | 277 75 | 34 00 | 28 00 | 15 |
| 365 30 | 343 90 | 90 50 | – | – | 190 00 | 173 30 | 170 30 | 12 50 | 6 00 | 16 |
| 283 00 | 283 00 | 107 00 | 27 00 | 27 00 | 105 00 | 71 30 | 71 30 | 10 00 | 4 00 | 17 |
| – | – | – | – | – | 6,534 00 | 4,230 00 | [4] 5,970 00 | – | – | 18 |
| – | – | – | – | – | – | – | – | – | – | 19 |
| 145 50 | 127 00 | – | – | – | 275 00 | 244 60 | 243 60 | – | – | 20 |
| 399 50 | 399 50 | 10 00 | 10 00 | 10 00 | 228 00 | 86 85 | 86 85 | – | – | 21 |
| 385 00 | 385 00 | 134 00 | 19 00 | 19 00 | 163 25 | 60 50 | 60 50 | 16 00 | – | 22 |
| 547 71 | 540 75 | 38 25 | 27 00 | 25 08 | 78 50 | 56 85 | 54 85 | 12 00 | 5 00 | 23 |
| – | – | – | – | – | 224 75 | 236 75 | 236 75 | – | – | 24 |
| 725 00 | 715 00 | 62 50 | 48 75 | 42 75 | 125 00 | 105 00 | 105 00 | 60 00 | 60 00 | 25 |
| 530 50 | 510 25 | – | – | – | 171 25 | 40 50 | 40 25 | 13 25 | 5 75 | 26 |
| 327 25 | 327 25 | 46 00 | 8 00 | 8 00 | 210 00 | 126 65 | 126 65 | 5 50 | 2 10 | 27 |
| 2,152 84 | 2,152 84 | – | – | – | 497 00 | 447 50 | 447 50 | 30 00 | 18 00 | 28 |
| 1,126 50 | 1,126 50 | – | – | – | 381 25 | 250 60 | 250 60 | 21 00 | 8 00 | 29 |
| 1,014 35 | 995 85 | – | – | – | [1] – | 201 50 | 201 50 | 30 00 | 22 00 | 30 |
| 698 00 | 651 00 | – | – | – | 200 00 | 145 75 | 145 75 | 21 00 | 13 00 | 31 |
| 910 00 | 910 00 | – | – | – | 187 75 | 95 50 | 95 50 | 15 00 | 8 00 | 32 |
| $17,740 30 | $17,184 74 | $1,442 25 | $485 75 | $477 83 | $12,871 20 | $9,296 55 | $10,887 05 | $460 75 | $269 85 | |

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[3] Held no fair and made no report.

[4] Awarded in 1906; paid in 1907.

## Analysis of Premiums and Gratuities, Membership and

| | SOCIETIES. | Amount paid under Head of Dairy Products. | Amount offered under Head of Domestic Manufactures. | Amount awarded under Head of Domestic Manufactures. | Amount paid under Head of Domestic Manufactures. | Amount awarded under Head of Miscellaneous. | Amount paid under Head of Miscellaneous. |
|---|---|---|---|---|---|---|---|
| 1 | Amesbury and Salisbury (Agricultural and Horticultural), . | $3 25 | [1] – | $98 75 | $98 75 | $142 84 | $142 84 |
| 2 | Barnstable County, . . . . . | 5 00 | $248 50 | 285 20 | 251 95 | 49 50 | 44 50 |
| 3 | Blackstone Valley, . . . . . | – | 23 50 | 20 00 | 20 00 | 50 00 | 50 00 |
| 4 | Bristol County Fair, Incorporated, | 6 00 | 422 00 | 301 55 | 264 15 | – | – |
| 5 | Deerfield Valley, . . . . . | 12 00 | 103 45 | 97 45 | 97 45 | 157 50 | 157 50 |
| 6 | Eastern Hampden, . . . . . | 22 00 | 60 75 | 51 00 | 51 00 | 31 10 | 31 10 |
| 7 | Essex, . . . . . . . . | – | 254 00 | 128 00 | 111 50 | 91 00 | 105 00 |
| 8 | Franklin County, . . . . . | 9 00 | 90 00 | 80 85 | 80 85 | – | – |
| 9 | Hampshire, . . . . . . | 1 50 | 116 00 | 45 50 | 37 12 | 20 00 | 4 00 |
| 10 | Hampshire, Franklin and Hampden, . . . . . . . . | 12 00 | 54 75 | 64 10 | 48 70 | 64 00 | 56 75 |
| 11 | Highland, . . . . . . . | 5 00 | 64 50 | 66 35 | 66 35 | 17 85 | 17 85 |
| 12 | Hillside, . . . . . . . . | 3 75 | 111 00 | 82 14 | 82 14 | 51 46 | 51 46 |
| 13 | Hingham (Agricultural and Horticultural), . . . . . . | 3 00 | 142 75 | 89 60 | 89 60 | 36 60 | 36 60 |
| 14 | Hoosac Valley, . . . . . . | 6 00 | [1] – | 173 67 | 173 67 | 120 50 | 120 50 |
| 15 | Housatonic, . . . . . . . | 28 00 | 520 25 | 349 50 | 349 50 | 36 50 | 36 50 |
| 16 | Marshfield (Agricultural and Horticultural), . . . . . . | 6 00 | 206 00 | 120 45 | 119 45 | 30 75 | 30 75 |
| 17 | Martha's Vineyard, . . . . . | 4 00 | 98 00 | 90 85 | 90 85 | 98 99 | 98 99 |
| 18 | Massachusetts Horticultural,[4] . | – | – | – | – | – | – |
| 19 | Massachusetts Society for Promoting Agriculture, . . . . | – | – | – | – | – | – |
| 20 | Middlesex North, . . . . . | – | 30 00 | 28 70 | 21 95 | 176 20 | 176 20 |
| 21 | Middlesex South, . . . . . | – | 100 00 | 50 10 | 50 10 | 108 95 | 108 65 |
| 22 | Nantucket, . . . . . . . | – | 60 00 | 91 75 | 91 75 | 55 20 | 55 20 |
| 23 | Oxford, . . . . . . . . | 4 50 | 82 50 | 47 10 | 47 10 | 34 00 | 34 00 |
| 24 | Plymouth County, . . . . . | – | 72 00 | 65 25 | 65 25 | – | – |
| 25 | Spencer (Farmers' and Mechanics' Association), . . . . . . | 60 00 | 50 00 | 28 00 | 25 75 | 15 50 | 15 50 |
| 26 | Union (Agricultural and Horticultural), . . . . . . . | 5 75 | 138 25 | 107 55 | 103 06 | 77 05 | 77 05 |
| 27 | Weymouth (Agricultural and Industrial), . . . . . . . | 2 10 | 165 15 | 104 00 | 104 00 | 45 75 | 45 75 |
| 28 | Worcester, . . . . . . . | 18 00 | 53 50 | 44 50 | 44 50 | 30 00 | 30 00 |
| 29 | Worcester East, . . . . . | 8 00 | 235 80 | 163 60 | 163 60 | 111 20 | 111 20 |
| 30 | Worcester Northwest (Agricultural and Mechanical), . . | 20 00 | [1] – | 48 45 | 43 50 | 21 00 | 21 00 |
| 31 | Worcester South, . . . . . | 13 00 | 95 00 | 48 50 | 45 00 | 101 75 | 79 25 |
| 32 | Worcester County West, . . | 8 00 | 99 40 | 65 80 | 65 80 | 103 00 | 103 00 |
| | | $265 85 | $3,697 55 | $3,038 26 | $2,904 40 | $1,877 89 | $1,841 14 |

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[1] Not reported.
[2] And gratuities.
[3] Estimated.

INSTITUTES, FOR THE YEAR ENDING DEC. 31, 1907 — *Concluded.*

| Amount paid for Trotting. | Number of Persons receiving Premiums. | Number of Persons receiving Gratuities. | Number of Cities and Towns where Premiums were paid. | Amount paid to Parties Outside the State. | Number of Male Members. | Number of Female Members. | Total Membership. | Number of Institute Sessions held. | Average Number attending Institutes. | |
|---|---|---|---|---|---|---|---|---|---|---|
| – | [2] 297 | – | 11 | $77 65 | 200 | 38 | 238 | 3 | 200 | 1 |
| $1,600 00 | 202 | 137 | 17 | – | 227 | 194 | 421 | 3 | 88 | 2 |
| – | 80 | 7 | 6 | – | 291 | 300 | 591 | 3 | 99 | 3 |
| 1,728 13 | 221 | – | 31 | 86 75 | 54 | – | 54 | 4 | 231 | 4 |
| 270 00 | 270 | – | 22 | 4 55 | 931 | 258 | 1,189 | 4 | 191 | 5 |
| 450 00 | [1] – | [1] – | 20 | 29 00 | 270 | 182 | 452 | 6 | 35 | 6 |
| – | 328 | – | 23 | – | 986 | 12 | 998 | 7 | 105 | 7 |
| 907 00 | 250 | 3 | 24 | 80 00 | [3] 1,400 | [3] 200 | [3] 1,600 | 3 | 34 | 8 |
| 280 00 | 98 | 1 | 17 | – | [1] – | [1] – | 600 | 4 | 242 | 9 |
| 492 00 | 275 | 5 | 25 | – | 619 | 255 | 874 | 5 | 181 | 10 |
| 65 00 | 124 | – | 18 | – | 252 | 120 | 372 | 3 | 29 | 11 |
| 50 00 | 350 | 2 | 15 | – | 696 | 43 | 739 | 6 | 149 | 12 |
| – | 62 | 156 | 6 | – | 370 | 161 | 531 | 3 | 103 | 13 |
| 820 00 | 120 | – | 9 | 44 50 | 511 | 5 | 516 | 3 | 92 | 14 |
| 3,505 50 | 374 | – | 13 | – | 1,567 | 72 | 1,639 | 5 | 83 | 15 |
| 1,375 00 | 84 | 291 | 22 | – | 530 | 301 | 831 | 5 | 61 | 16 |
| 68 00 | [1] – | [1] – | 6 | – | 86 | 85 | 171 | 3 | 37 | 17 |
| – | 217 | 115 | 100 | 121 00 | 726 | 114 | 840 | 10 | 124 | 18 |
| – | – | – | – | – | – | – | – | – | – | 19 |
| – | 130 | 14 | 9 | – | 1,112 | 445 | 1,557 | 7 | 300 | 20 |
| 510 00 | 112 | 25 | 18 | – | 299 | 191 | 490 | 3 | 52 | 21 |
| 220 00 | 70 | 34 | 1 | – | 204 | 373 | 577 | 3 | 17 | 22 |
| 735 00 | [1] – | [1] – | 13 | – | 355 | 278 | 633 | 3 | 65 | 23 |
| – | [1] – | [1] – | 7 | – | 610 | 512 | 1,122 | 5 | 46 | 24 |
| 750 00 | 145 | 5 | 21 | – | 471 | 411 | 882 | 4 | 40 | 25 |
| 362 00 | 149 | 53 | 17 | 50 | 652 | 830 | 1,482 | 3 | 237 | 26 |
| 712 50 | [1] – | [1] – | 23 | 40 45 | 480 | 14 | 494 | 3 | 75 | 27 |
| 500 00 | 209 | – | 30 | 543 00 | 1,675 | 176 | 1,851 | 6 | 117 | 28 |
| – | 323 | – | 39 | 22 25 | 468 | 295 | 763 | 6 | 147 | 29 |
| 1,100 00 | 177 | – | 32 | 21 25 | 648 | 308 | 956 | 4 | 130 | 30 |
| 950 00 | 89 | 50 | 31 | 129 00 | 758 | 740 | 1,498 | 5 | 62 | 31 |
| 528 50 | 134 | 79 | 31 | 201 00 | 405 | 760 | 1,165 | 4 | 90 | 32 |
| $17,978 63 | 4,890 | 977 | 657 | $1,400 90 | 17,853 | 7,673 | 26,126 | 136 | [5] 125 | |

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[4] Held no fair and made no report.

[5] General average of attendance.

# DIRECTORY

OF THE

# AGRICULTURAL AND SIMILAR ORGANIZATIONS IN MASSACHUSETTS.

MAY, 1908.

# STATE BOARD OF AGRICULTURE, 1908.

### Members ex Officio.

HIS EXCELLENCY CURTIS GUILD, JR.
HIS HONOR EBEN S. DRAPER.
HON. WM. M. OLIN, *Secretary of the Commonwealth.*
KENYON L. BUTTERFIELD, M.A., *President Massachusetts Agricultural College.*
C. A. GOESSMANN, PH.D., LL.D., *Chemist of the Board.*
AUSTIN PETERS, M.R.C.V.S., *Chief of the Cattle Bureau.*
F. WM. RANE, B. AGR. M.S., *State Forester.*
J. LEWIS ELLSWORTH, *Secretary of the Board.*

### Members appointed by the Governor and Council.

| | Term expires |
|---|---|
| HENRY M. HOWARD of West Newton, | 1909 |
| WARREN C. JEWETT of Worcester, | 1910 |
| CHARLES E. WARD of Buckland, | 1911 |

### Members chosen by the Incorporated Societies.

| | | |
|---|---|---|
| *Amesbury and Salisbury (Agr'l and Hort'l),* | J. J. MASON of Amesbury, | 1909 |
| *Barnstable County,* | JOHN BURSLEY of West Barnstable, | 1910 |
| *Blackstone Valley,* | SAMUEL B. TAFT of Uxbridge, | 1909 |
| *Bristol County Fair, Inc.,* | WM. N. HOWARD of South Easton, | 1910 |
| *Deerfield Valley,* | WM. B. AVERY of East Charlemont, | 1911 |
| *Eastern Hampden,* | O. E. BRADWAY of Monson, | 1909 |
| *Essex,* | FREDERICK A. RUSSELL of Methuen, | 1911 |
| *Franklin County,* | FRANK GERRETT of Greenfield, | 1910 |
| *Hampshire,* | HENRY E. PAIGE of Amherst, | 1910 |
| *Hampshire, Franklin and Hampden,* | WM. A. BAILEY of Northampton, | 1909 |
| *Highland,* | HENRY S. PEASE of Middlefield (P. O. Chester, R. F. D.), | 1911 |
| *Hillside,* | W. A. HARLOW of Cummington, | 1911 |
| *Hingham (Agr'l and Hort'l),* | EDMUND HERSEY of Hingham, | 1909 |
| *Hoosac Valley,* | A. M. STEVENS of Williamstown, | 1909 |
| *Housatonic,* | EDWIN L. BOARDMAN of Sheffield, | 1909 |
| *Marshfield (Agr'l and Hort'l),* | H. A. OAKMAN of North Marshfield, | 1909 |
| *Martha's Vineyard,* | JAMES F. ADAMS of West Tisbury, | 1910 |
| *Massachusetts Horticultural,* | WILFRID WHEELER[1] of Concord, | 1909 |
| *Massachusetts Society for Promoting Agriculture,* | N. I. BOWDITCH of Framingham, | 1909 |
| *Middlesex North,* | GEO. W. TRULL of Tewksbury, (P. O. Lowell, R. F. D.) | 1911 |
| *Middlesex South,* | ISAAC DAMON of Wayland (P. O. Cochituate), | 1911 |
| *Nantucket,* | H. G. WORTH of Nantucket, | 1909 |
| *Oxford,* | WALTER A. LOVETT of Oxford, | 1910 |
| *Plymouth County,* | AUGUSTUS PRATT of North Middleborough, | 1911 |
| *Spencer (Far's and Mech's Assoc'n),* | NOAH SAGENDORPH of Spencer, | 1910 |
| *Union (Agr'l and Hort'l),* | GEORGE O. MILLARD of Blandford, | 1910 |
| *Weymouth (Agr'l and Ind'l),* | THERON L. TIRRELL of South Weymouth, | 1909 |
| *Worcester,* | B. W. POTTER of Worcester, | 1911 |
| *Worcester East,* | W. A. KILBOURN of South Lancaster, | 1909 |
| *Worcester Northwest (Agr'l and Mech'l),* | ALBERT ELLSWORTH of Athol, | 1910 |
| *Worcester South,* | C. D. RICHARDSON of West Brookfield, | 1910 |
| *Worcester County West,* | JOHN L. SMITH of Barre, | 1911 |

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[1] Elected to fill unexpired term of Wm. H. Spooner of Jamaica Plain; deceased March 21, 1908.

# ORGANIZATION OF THE BOARD.

## OFFICERS.

| | |
|---|---|
| *President,* . . | His Excellency CURTIS GUILD, Jr., *ex officio.* |
| *1st Vice-President,* | AUGUSTUS PRATT of North Middleborough. |
| *2d Vice-President,* . | JOHN BURSLEY of West Barnstable. |
| *Secretary,* . . | J. LEWIS ELLSWORTH of Worcester. |

Office, Room 136, State House, Boston.

## COMMITTEES.

### Executive Committee.

Messrs. W. A. Kilbourn of South Lancaster.
John Bursley of West Barnstable.
N. I. Bowditch of Framingham.
H. G. Worth of Nantucket.
Augustus Pratt of North Middleborough.
C. D. Richardson of West Brookfield.
Edmund Hersey of Hingham.
Henry E. Paige of Amherst.

### Committee on Agricultural Societies.

Messrs. W. A. Kilbourn of South Lancaster.
T. L. Tirrell of South Weymouth.
O. E. Bradway of Monson.
Albert Ellsworth of Athol.
Wm. B. Avery of Charlemont.

### Committee on Domestic Animals and Sanitation.

Messrs. Henry E. Paige of Amherst.
A. M. Stevens of Williamstown.
Walter A. Lovett of Oxford.
F. A. Russell of Methuen.
W. A. Harlow of Cummington.

### Committee on Gypsy Moth, Insects and Birds.

Messrs. Augustus Pratt of North Middleborough.
F. A. Russell of Methuen.
Noah Sagendorph of Spencer.
B. W. Potter of Worcester.
Geo. W. Trull of Tewksbury.

### Committee on Dairy Bureau and Agricultural Products.

Messrs. C. D. Richardson of West Brookfield.
W. C. Jewett of Worcester.
Henry E. Paige of Amherst.
S. B. Taft of Uxbridge.
George O. Millard of Blandford.

### Committee on Massachusetts Agricultural College.

Messrs. John Bursley of West Barnstable.
W. C. Jewett of Worcester.
Isaac Damon of Wayland.
E. L. Boardman of Sheffield.
Frank Gerrett of Greenfield.

### Committee on Experiments and Station Work.

Messrs. N. I. Bowditch of Framingham.
T. L. Tirrell of South Weymouth.
J. L. Smith of Barre.
Henry S. Pease of Middlefield.
Wilfrid Wheeler of Concord.

### Committee on Forestry, Roads and Roadside Improvements.

Messrs. H. G. Worth of Nantucket.
J. J. Mason of Amesbury.
F. Wm. Rane of Boston.
Wm. N. Howard of South Easton.
H. A. Oakman of North Marshfield.

### Committee on Institutes and Public Meetings.

Messrs. Edmund Hersey of Hingham.
Wm. A. Bailey of Northampton.
Kenyon L. Butterfield of Amherst.
J. F. Adams of West Tisbury.
Chas. E. Ward of Buckland.
H. M. Howard of West Newton.

The secretary is a member, *ex officio*, of each of the above committees.

## DAIRY BUREAU.

Messrs. C. D. Richardson of West Brookfield, 1908; Henry E. Paige of Amherst, 1909; W. C. Jewett of Worcester, 1910.

*Executive Officer*, . . . . . . . J. L. Ellsworth.
*General Agent*, . . . . . . . . P. M. Harwood of Barre.

Office, Room 136, State House.

## STATE NURSERY INSPECTOR.

Henry T. Fernald, Ph.D., of Amherst.

## STATE ORNITHOLOGIST.

Edward Howe Forbush of Wareham.
Office, Room 136, State House, Boston.

## SPECIALISTS.

### By Election of the Board.

| | | |
|---|---|---|
| *Chemist*, | Dr. C. A. Goessmann, | Amherst. |
| *Entomologist*, | Prof. C. H. Fernald, | Amherst. |
| *Botanist*, | Dr. Geo. E. Stone, | Amherst. |
| *Pomologist*, | Prof. F. C. Sears, | Amherst. |
| *Veterinarian*, | Prof. James B. Paige, | Amherst. |
| *Engineer*, | Wm. Wheeler, | Concord. |
| *Ornithologist*, | E. H. Forbush, | Wareham. |

### By Appointment of the Secretary.

*Librarian*, F. H. Fowler, B.Sc., *First Clerk*.

# MASSACHUSETTS AGRICULTURAL COLLEGE.

*Location, Amherst, Hampshire County.*

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### BOARD OF TRUSTEES.

| | Term expires |
|---|---|
| ARTHUR G. POLLARD of Lowell, | 1909 |
| CHARLES A. GLEASON of Springfield, | 1909 |
| FRANK GERRETT of Greenfield, | 1910 |
| SAMUEL C. DAMON of Lancaster, | 1910 |
| WARREN W. RAWSON of Arlington, | 1911 |
| CHARLES W. PRESTON of Danvers, | 1911 |
| CARROLL D. WRIGHT of Worcester, | 1912 |
| M. FAYETTE DICKINSON of Boston, | 1912 |
| WILLIAM H. BOWKER of Boston, | 1913 |
| GEORGE H. ELLIS of Newton, | 1913 |
| J. HOWE DEMOND of Northampton, | 1914 |
| ELMER D. HOWE of Marlborough, | 1914 |
| NATHANIEL I. BOWDITCH of Framingham, | 1915 |
| WILLIAM WHEELER of Concord, | 1915 |

### MEMBERS EX OFFICIO.

His Excellency Governor CURTIS GUILD, Jr.,
*President of the Corporation.*

| | |
|---|---|
| KENYON L. BUTTERFIELD, M.A., | *President of the College.* |
| GEORGE H. MARTIN, | *Secretary of the Board of Education.* |
| J. LEWIS ELLSWORTH, | *Secretary of the Board of Agriculture.* |

### OFFICERS ELECTED BY THE BOARD OF TRUSTEES.

| | |
|---|---|
| CHARLES A. GLEASON of Springfield, | *Vice-President of the Corporation.* |
| J. LEWIS ELLSWORTH of Worcester, | *Secretary.* |
| FRED C. KENNEY of Amherst, | *Treasurer.* |
| CHARLES A. GLEASON of Springfield, | *Auditor.* |
| KENYON L. BUTTERFIELD, M.A., of Amherst, | *President of the College.* |

### BOARD OF OVERSEERS.

The State Board of Agriculture.

### EXAMINING COMMITTEE OF THE BOARD OF AGRICULTURE.

Messrs. BURSLEY, JEWETT, DAMON, BOARDMAN and GERRETT.

### MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION.

| | |
|---|---|
| WM. P. BROOKS, Ph.D., | *Director and Agriculturist.* |
| CHAS. A. GOESSMANN, Ph.D., LL.D., | *Honorary Director and Expert Consulting Chemist.* |
| JOSEPH B. LINDSEY, Ph.D., | *Chemist.* |
| FRANK A. WAUGH, M.S., | *Horticulturist.* |
| E. A. WHITE, B.Sc., | *Floriculturist.* |
| GEORGE E. STONE, Ph.D., | *Botanist and Vegetable Pathologist.* |
| CHARLES H. FERNALD, Ph.D., | *Entomologist.* |
| JAMES B. PAIGE, B.S., D.V.S., | *Veterinarian.* |
| JOHN E. OSTRANDER, M.A., C.E., | *Meteorologist.* |

## Agricultural Societies incorporated by Special Act of the Legislature, and represented on the Board of Agriculture.

| NAME. | PRESIDENT. | SECRETARY. | TREASURER. |
|---|---|---|---|
| Amesbury and Salisbury,[1] . . | A. W. Bartlett, Salisbury. | M. H. Sands, Amesbury. | John J. Mason, Amesbury. |
| Barnstable County, . . . . | Dr. Gorham Bacon, Yarmouth. | M. N. Harris, Barnstable. | Henry C. Davis, Cummaquid. |
| Blackstone Valley, . . . . | W. A. L. Bazeley, Boston. | Dr. M. R. Sharpe, Uxbridge. | Dr. M. R. Sharpe, Uxbridge. |
| Bristol County Fair, Inc., . . | Willis K. Hodgman, Taunton. | Arthur Staples, Taunton. | Wm. N. Howard, North Easton. |
| Deerfield Valley, . . . . . | D. T. Barnard, Shelburne. | S. W. Hawkes, Charlemont. | E. F. Haskins, Charlemont. |
| Eastern Hampden, . . . . | O. E. Bradway, Monson. | L. E. Chandler, Palmer. | W. L. Shaw, Palmer. |
| Essex, . . . . . . . . | Fred'k A. Russell, Methuen. | J. M. Danforth, Lynnfield. | W. S. Nichols, Salem. |
| Franklin County, . . . . . | Chas. P. Aldrich, Greenfield. | J. H. Murphy, Greenfield. | Frank H. Snow, Greenfield. |
| Hampshire, . . . . . . . | H. A. Parsons, Amherst. | C. S. Walker, Amherst. | C. S. Walker, Amherst. |
| Hampshire, Franklin and Hampden. | Frank P. Newkirk, Easthampton. | C. A. Montgomery, Northampton. | C. A. Montgomery, Northampton. |
| Highland, . . . . . . . | Henry E. Stanton, Huntington. | J. T. Bryan, Middlefield. | Geo. S. Bell, Middlefield. |
| Hillside, . . . . . . . . | H. S. Packard, Plainfield. | C. F. Burr, Ringville. | Robert L. Streeter, Cummington. |
| Hingham,[1] . . . . . . . | Geo. E. Kimball, Hingham. | William H. Thomas, Hingham. | Reuben Sprague, Hingham. |
| Hoosac Valley, . . . . . | Dr. F. D. Stafford, North Adams. | Gilbert Maxwell, North Adams. | M. R. Ford, North Adams. |
| Housatonic, . . . . . . . | C. H. Warner, Sheffield. | Fred J. Fuller, Great Barrington. | Geo. L. Taylor, Great Barrington. |
| Marshfield,[1] . . . . . . . | Thomas W. Lawson, Boston. | I. H. Hatch, North Marshfield. | M. H. Kent, Marshfield. |
| Martha's Vineyard, . . . . | B. T. Hillman, Edgartown. | F. A. Look, West Tisbury. | Geo. H. Luce, West Tisbury. |
| Massachusetts Horticultural, . | Gen. S. M. Weld, Dedham. | Wm. P. Rich, Boston. | Walter Hunnewell, Wellesley. |
| Massachusetts Society for Promoting Agriculture. | C. S. Sargent, Brookline. | Francis H. Appleton, Peabody. | R. M. Saltonstall, Newton. |
| Middlesex North, . . . . . | Arthur H. Clner, Lowell. | Andrew Liddell, Lowell. | John A. Weinbeck, Lowell. |
| Middlesex South, . . . . . | John J. Erwin, Wayland. | Geo. C. Blades, South Framingham. | George E. Fay, Framingham. |
| Nantucket, . . . . . . . | H. G. Worth, Nantucket. | B. F. Worth, Nantucket. | Asa C. Jones, Nantucket. |
| Oxford, . . . . . . . . | L. F. Kilty, Oxford. | J. E. Darling, Oxford. | J. E. Darling, Oxford. |

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[1] And horticultural.

## AGRICULTURAL SOCIETIES, ETC. — *Concluded.*

| NAME. | PRESIDENT. | SECRETARY. | TREASURER. |
|---|---|---|---|
| Plymouth County, | Augustus Pratt, North Middleborough. | J. Herbert Leonard, Bridgewater. | J. Herbert Leonard, Bridgewater. |
| Spencer Farmers' and Mechanics' Association. | Walter C. Bemis, Spencer. | Geo. H. Ramer, Spencer. | Geo. H. Ramer, Spencer. |
| Union,[1] | H. K. Herrick, Blandford. | E. W. Boise, Blandford. | Geo. O. Millard, Blandford. |
| Weymouth (Ag'l and Ind.), | Josiah B. Reed, South Weymouth. | A. F. Barnes, South Weymouth. | E. J. Pitcher, South Weymouth. |
| Worcester, | Walter D. Ross, Worcester. | E. S. Knowles, Worcester. | L. F. Herrick, Worcester. |
| Worcester East, | John E. Thayer, Lancaster. | Warren Goodale, Clinton. | Lucius Field, Clinton. |
| Worcester Northwest (Agricultural and Mechanical). | F. G. Amsden, Athol. | Albert Ellsworth, Athol. | E. L. Worrick, Athol. |
| Worcester South, | W. E. Patrick, Warren. | C. V. Corey, Sturbridge. | C. V. Corey, Sturbridge. |
| Worcester County West, | Joel L. Powers, Hardwick. | D. H. Rice, Barre. | M. H. Bacon, Barre. |

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[1] And horticultural.

## HORTICULTURAL SOCIETIES.

| NAME. | LOCATION. | PRESIDENT. | SECRETARY. |
|---|---|---|---|
| Haverhill, | Haverhill, | Walter Goodrich, Haverhill. | Mrs. William M. Webster, Haverhill. |
| Hampden County, | Springfield, | Adolph Mielliz, Springfield. | William F. Gale, Springfield. |
| Houghton, | Lynn, | Philip Emerson, Lynn. | Helen L. Newhall, Lynn. |
| Lenox, | Lenox, | Walter Jack, Lenox. | Geo. H. Instone, Lenox. |
| Massachusetts, | The State, | Arthur F. Estabrook, Boston. | Wm. P. Rich, Boston. |
| North Shore, | Manchester, | Wm. Till, Magnolia. | James Salter, Manchester. |
| Springfield Amateur, | Springfield, | W. T. Hutchins, Indian Orchard. | Chas. L. Burr, Springfield. |
| Worcester County, | Worcester, | Geo. C. Rice, Worcester. | Adin A. Hixon, Worcester. |

## FARMERS' AND MECHANICS' ASSOCIATIONS.

| | | | |
|---|---|---|---|
| Bolton, | Bolton, | Legrand F. Brigham, Bolton. | William M. Brigham, Bolton. |
| Needham, | Needham, | Geo. N. Smith, Wellesley Hills. | Geo. D. Adams, Wellesley. |
| Oakham, | Oakham, | Wayland Angier, Oakham. | Miss Lilla Robinson, Oakham. |
| Princeton, | Princeton, | J. C. F. Mirick, Princeton. | J. E. Merriam, Princeton. |
| Westminster, | Westminster, | C. F. Giles, Westminster. | A. L. Stone, Westminster. |

## FARMERS' AND MECHANICS' CLUBS.

| | | | |
|---|---|---|---|
| Ashburnham, | Ashburnham, | E. J. Forristall, South Ashburnham. | W. E. Jefts, Ashburnham. |
| Belchertown, | Belchertown, | Harry H. Ward, Belchertown. | Almon L. Pratt, Belchertown. |
| Groton, | Groton, | Wm. A. Lawrence, Groton. | L. H. Sheedy, Groton. |
| Holden, | Holden, | Irving Dunn, Holden. | Mrs. H. J. Jones, Holden. |
| Pepperell, | Pepperell, | H. W. Hutchinson, Pepperell. | Chas. F. Spaulding, Pepperell. |
| Shirley, | Shirley, | H. S. Hazen, Shirley Centre. | M. W. Longley, Shirley Centre. |
| Shrewsbury, | Shrewsbury, | E. A. Bartlett, Shrewsbury. | F. J. Stone, Shrewsbury. |

## FARMERS' CLUBS.

| NAME. | LOCATION. | PRESIDENT. | SECRETARY. |
|---|---|---|---|
| Boxborough, | Boxborough, | R. Y. Nelson, Boxborough. | G. W. Burroughs, Boxborough. |
| Buckland, | Buckland, | Chas. E. Ward, Buckland. | W. D. Forbes, Shelburne Falls. |
| Chamberlain District, | Worcester, | Pliny Moore, Worcester. | S. A. Burgess, Worcester. |
| East Charlemont, | East Charlemont, | W. W. Smith, East Charlemont. | Geo. H. Wheeler, East Charlemont. |
| Easthampton, | Easthampton, | E. H. Clark, Easthampton. | C. W. Smith, Easthampton. |
| Franklin, | Franklin, | L. W. Daniels, Franklin. | Fred M. Thayer, Franklin. |
| Halifax, | Halifax, | Jas. T. Thomas, Halifax. | Mrs. Geo. W. Hayward, Halifax. |
| Lancaster, | Lancaster, | George F. Morse, South Lancaster. | F. A. Hanaford, South Lancaster. |
| New Braintree, | New Braintree, | Jas. E. Barr, New Braintree. | Chas. S. Lane, New Braintree. |
| Rehoboth, | Rehoboth, | Dr. C. N. Raymond, Rehoboth. | Wm. H. Gladding, Rehoboth. |
| Rowley, | Rowley, | J. D Dodge, Rowley. | T. P. Hale, Rowley. |
| South Bristol, | New Bedford, | Herbert Wing, South Dartmouth. | Allen Russell, Jr., Acushnet. |
| Tatnuck, | Worcester, | Edw. H. Moore, Worcester. | H. Ward Moore, Worcester. |
| Upton, | Upton, | Appleton P. Williams, Upton. | Edward B. Newton, Upton. |
| West Brookfield, | West Brookfield, | Fred G. Smith, West Brookfield. | Sumner H. Reed, West Brookfield. |
| Wilbraham, | Wilbraham, | B. F. Green, North Wilbraham. | H. M. Bliss, R. F. D. 2, Ludlow. |

## POULTRY ASSOCIATIONS.

| | | | |
|---|---|---|---|
| Athol Poultry and Pet Stock Association, | Athol, | - - | J. E. Burt, Athol. |
| Brockton Poultry Association, | Brockton, | M. E. Holmes, Campello. | C. A. Brown, Brockton. |
| Essex County Poultry Association, | Beverly, | Daniel P. Foster, North Beverly. | Walter R. Bell, Manchester. |
| Falmouth Poultry Association, | Falmouth, | E. P. Davis, Falmouth. | R. E. Small, Falmouth. |
| Fitchburg Poultry and Pet Stock Association. | Fitchburg, | Henry Shaw, Leominster. | L. D. Mudgett, Leominster. |
| Greenfield Score Card Poultry Club, | Greenfield, | H. M. Woodward, Greenfield. | F. L. Gaines, Greenfield. |
| Lawrence Poultry and Pet Stock Association. | Lawrence, | B. D. Todd, Lawrence. | Asa L. Harris, Lawrence. |
| Lynn Poultry Association, | Lynn, | J. Fred Bessom, Lynn. | Chas. E. Hunt, Lynn. |
| Milford Poultry Association, | Milford, | H. W. Reed, Caryville. | W. H. Pyne, Milford. |
| North Abington Poultry Association, | North Abington, | Chas. W. Pratt, North Abington. | Jas. H. Dwyer, North Abington. |
| North Adams Poultry Association, | North Adams, | W. G. Carter, North Adams. | C. M. Ottman, North Adams. |
| Northampton Poultry Association, | Northampton, | C. E. Hodgkins, Northampton. | C. L. Gallup, Northampton. |
| Plymouth Poultry Association, | Plymouth, | T. Allen Bagnell, Plymouth. | F. C. Chandler, Kingston. |
| Springfield Poultry and Pet Stock Association. | Springfield, | E. C. Powell, Longmeadow. | E. S. Evans, Springfield. |
| West Brookfield Poultry Association, | West Brookfield, | R. H. Buffington, West Brookfield. | E. L. Richardson, West Brookfield. |

## MISCELLANEOUS.

| NAME. | LOCATION. | PRESIDENT. | SECRETARY. |
|---|---|---|---|
| Agricultural Society of Harvard University, | Cambridge, | Geo. L. Wilson, Cambridge. | Harold Styles, Cambridge. |
| Bay State Agricultural Society, | The State, | C. Minot Weld, Boston. | N. I. Bowditch, Framingham. |
| Boston Market Gardeners' Association, | Boston and vicinity, | W. W. Rawson, Arlington. | J. B. Shurtleff, Jr., Revere. |
| Brockton Agricultural Society, | Brockton, | Charles Howard, Brockton. | Baalis Sanford, Brockton. |
| Connecticut Valley Live Stock Association, | Western New England, | George E. Taylor, Shelburne. | O. C. Burt, Easthampton. |
| Cranberry Growers' Association, | Cape Cod District, | George R. Briggs, Bournedale. | Wm. M. Marsh, Boston. |
| Franklin Harvest Club, | Connecticut Valley, | Frank Gerrett, Greenfield. | C. B. Lyman, Southampton. |
| Hampden Agricultural Society, | Springfield, | C. W. Bemis, Longmeadow. | E. S. Batchelder, Springfield. |
| Hampden Harvest Club, | Connecticut Valley, | The members alternately. | Edwin C. Powell, Springfield. |
| Massachusetts Cattle Owners' Association, | The State, | B. W. Potter, Worcester. | J. L. Harrington, Lunenburg. |
| Massachusetts Creamery Association, | The State, | W. H. Wright, Easthampton. | A. M. Lyman, Montague. |
| Massachusetts Forestry Association, | The State, | Dr. Henry P. Walcott, Cambridge. | Edwin A. Start, Boston. |
| Massachusetts Fruit Growers' Association, | The State, | John W. Clark, North Hadley. | Chas. A. Whitney, Upton. |
| Stockbridge Club, | Amherst, | Jasper F. Eastman, Amherst. | John Daniel, Amherst. |
| Wakefield-Reading Fair Company, | Wakefield, | George A. Shackford, Reading. | B. F. Calley, Jr., Wakefield. |
| Ware Agricultural Society, | Ware, | F. F. Gilmore, Ware. | E. P. Lovett, Ware. |
| Worcester County Harvest Club, | Worcester, | B. W. Potter, Worcester. | Mrs. W. C. Jewett, Worcester. |
| Worcester County Bee-keepers' Association, | Worcester, | Jas. P. Porter, Worcester. | Adin A. Hixon, Worcester. |
| Worcester North Agricultural Society, | Fitchburg, | H. O. Mead, Lunenburg. | W. H. Laws, Ashburnham. |

# MASSACHUSETTS PATRONS OF HUSBANDRY.

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### Officers of the State Grange, 1908.

| | |
|---|---|
| Master, | Carlton D. Richardson of West Brookfield. |
| Overseer, | John E. Gifford of Sutton. |
| Lecturer, | Charles M. Gardner of Westfield. |
| Steward, | C. C. Colby of Hubbardston. |
| Assistant Steward, | C. O. Littlefield of Norwood. |
| Chaplain, | Rev. A. H. Wheelock of Marlborough. |
| Treasurer, | Hon. F. A. Harrington of Worcester. |
| Secretary, | Wm. N. Howard of South Easton. |
| Gate Keeper, | Wm. P. Greenwood of Milford. |
| Ceres, | Mrs. Ida Coleman of Richmond. |
| Pomona, | Mrs. Nellie S. Stevens of Wellesley. |
| Flora, | Miss Philomene Cook of Methuen. |
| Lady Assistant Steward, | Mrs. S. Mabel Thompson of Hopkinton. |

### Executive Committee.

| | |
|---|---|
| George S. Ladd, | Southbridge. |
| C. A. Dennen, | Pepperell. |
| W. C. Jewett, | Worcester. |

### General Deputies.

| | |
|---|---|
| Henry A. Barton, | Dalton. |
| N. B. Douglas, | Sherborn. |
| Elmer D. Howe, | Marlborough. |
| W. C. Jewett, | Worcester. |
| G. S. Ladd, | Sturbridge. |
| M. A. Morse, | Belchertown. |
| Herbert Sabin, | Amherst. |

### Pomona Deputies.

| | |
|---|---|
| A. C. Stoddard, | North Brookfield. |
| William E. Patrick, | Warren. |
| Mrs. S. Ella Southland, | Athol. |

### Subordinate Deputies.

| | |
|---|---|
| C. H. Shaylor, | Lee. |
| T. E. Flarity, | Townsend. |
| E. E. Chapman, | Ludlow. |
| F. L. Warfield, | Buckland. |
| E. F. Richardson, | Millis. |
| John Bursley, | West Barnstable. |
| L. R. Smith, | Hadley. |
| Moses U. Gaskill, | Mendon. |
| C. R. Damon, | Williamsburg. |
| E. B. Hale, | Bernardston. |
| H. N. Jenks, | Cheshire. |
| G. C. Sevey, | Springfield. |
| Elbridge Noyes, | Newbury. |

### SUBORDINATE DEPUTIES — *Con.*

| | |
|---|---|
| Geo. E. Crosby, | Tewksbury. |
| E. H. Gilbert, | Stoughton. |
| Harry C. Shepard, | Sturbridge. |
| Frank N. Boutelle, | North Leominster. |
| E. W. Burtt, | Andover. |
| George W. Sherman, | Brimfield. |
| W. H. Sawyer, | Winchendon. |
| L. H. Cudworth, | Oxford. |
| W. A. Harlow, | Cummington. |

### SPECIAL DEPUTIES.

| | |
|---|---|
| John E. Gifford, | Sutton. |
| W. N. Howard, | South Easton. |
| J. P. Ranger, | North Brookfield. |
| W. T. Herrick, | Westborough. |

### COMMITTEE ON WOMEN'S WORK.

| | |
|---|---|
| Mrs. H. E. Cummings, | North Brookfield. |
| Mrs. D. P. Bardwell, | Bardwell's Ferry. |
| Mrs. W. A. Munson, | Huntington. |
| Mrs. Fred Reed, | Shrewsbury. |

## MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

| NAME. | MASTER. | LECTURER. | SECRETARY. |
|---|---|---|---|
| *Pomona Granges.* | | | |
| Middlesex and Norfolk, No. 1, . | Harry A. Whiting, South Walpole. | Elijah Barber, Sherborn. | J. Herbert Baker, Medfield. |
| Essex County, No. 2, . . . | Samuel Emerson, Methuen. | Mrs. Elizabeth M. Newell, West Newbury. | Miss Matilda B. Lund, Ward Hill, R. F. D., No. 1. |
| Middlesex-Worcester, No. 3, . | Frank N. Boutelle, North Leominster. | Mrs. D. W. Mason, Ayer. | Mrs. Minnie L. F. Knight, Townsend Harbor. |
| Franklin and Worcester, No. 4, . | Mrs. S. Ella Southland, Athol. | Mrs. A. K. Litchfield, Athol. | A. J. Hastings, Orange, R. F. D., No. 2. |
| Worcester West, No. 5, . . . | Henry Seaver, Templeton. | Rev. P. R. Crowell, Petersham. | Rachel S. Titterton, Templeton. |
| Berkshire County, No. 6, . . | H. N. Jenks, Adams, R. F. D. | F. V. Petit, Housatonic, R. F. D. | R. P. Coleman, Pittsfield, R. F. D. |
| Worcester Central, No. 7, . . | W. H. Wellington, Upton. | Mrs. C. H. Freeman, Worcester. | Mrs. Adelle E. Grout, Box 669, Worcester. |
| Hampshire County, No. 8, . . | John McQueston, South Hadley. | Hon. E. I. Clapp, Northampton. | John W. Marsh, Hadley. |
| Worcester Southwest, No. 9, . | Harry C. Shepard, Globe Village. | Mrs. Phila Holmes, Fiskdale. | Mary Q. Ainsworth, E. Brookfield. |
| Worcester and Norfolk, No. 10, . | Moses U. Gaskill, Mendon. | Frank H. Wood, Mendon. | A. W. Gaskill, Mendon. |
| Borough, No. 11, . . . . | Herbert Wheeler, Berlin. | Mrs. S. Mabel Thompson, Westborough, R. F. D., No. 2. | Mrs. Maria A. Gilmore, Westborough, R. F. D., No. 2. |
| Springfield, No. 12, . . . . | Frank M. Graves, Granby. | Mrs. J. T. Geer, Palmer. | Mrs. Carrie L. Hayward, Agawam. |
| Old Colony, No. 13, . . . | Joseph W. Baldwin, North Easton. | Ernest H. Gilbert, N. Easton, R. F. D. | Mrs. Alida N. Stevens, South Braintree. |
| Worcester East, No. 14, . . | J. S. Burpee, Sterling. | Laura E. W. Farnsworth, Lancaster. | Ida A. Cunningham, Lancaster. |
| Quaboag, No. 15, . . . . | H. N. Shepard, Warren. | Mrs. Ida L. Warren, Spencer. | Mrs. Nellie M. Smoth, West Brookfield. |
| Middlesex North, No. 16, . . | George P. Greenwood, Billerica. | Mrs. Alice B. Colburn, Lowell, R. F. D., No. 3. | Mrs. Mabel H. Peavey, Lowell, R. F. D., No. 3. |
| Deerfield Valley, No. 17, . . | Clinton A. Hawkes, Charlemont. | Mrs. D. P. Bardwell, Bardwell's Ferry. | Miss Mary C. Burrington, Heath. |
| Western Hampden, No. 18, . . | W. T. Moore, Huntington. | C. M. Gardner, Westfield. | Miss Annette Sackett, Westfield. |
| Connecticut Valley, No. 19, . . | Rev. Richard Birk, Deerfield. | Capt. Geo. Davenport, Greenfield. | Mrs. Nellie Hale, Greenfield. |
| Hillside, No. 20, . . . . | Charles A. Williams, Plainfield. | Perley A. Skelton, Worthington. | Mrs. A. R. Tirrell, Plainfield. |
| Swift River Valley, No. 21, . . | Fred E. Alden, Greenwich Village. | Mrs. J. V. Lincoln, Greenwich Village. | Mrs. Geneva Sieg Ballard, Millington. |

MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

| NAME. | MASTER. | LECTURER. | SECRETARY. |
|---|---|---|---|
| *Subordinate Granges.* | | | |
| Acton, No. 259, | James B. Tuttle, Acton. | Mrs. O. D. Wood, Acton. | Miss Ella L. Miller, North Acton. |
| Adams, No. 34, | Mrs. L. E. Dudley, Adams. | Mrs. C. A. Daniels, Adams. | Ora Dudley, Adams. |
| Amesbury, No. 127, | E. M. Currier, Amesbury. | Mrs. Abbie M. Babb, Amesbury. | C. F. Tibbetts, Amesbury. |
| Amherst, No. 16, | Prof. F. A. Waugh, Amherst. | Mrs. E. E. Perry, Amherst. | Mrs. T. E. Brigham, Amherst. |
| Andover, No. 183, | Ralph A. Bailey, Andover. | Gayton Abbott, Andover, R. F. D. | Edward W. Burtt, Andover, R. F. D. |
| "Anawan" of Rehoboth, No. 221, | S. O. Horton, Rehoboth, R. F. D., No. 1. | Mrs. A. A. Carpenter, Rehoboth. | Mrs. Lillian C. Eddy, Rehoboth, R. F. D., No. 2. |
| Ashby, No. 172, | Fred Shattuck, Ashby. | Mrs. F. Ella Ingerson, Ashby. | W. S. Green, Ashby. |
| Ashburnham, No. 202, | Chas. I. Jefts, Ashburnham, R. F. D. | Miss Ardella M. Jefts, Ashburnham, R. F. D. | Mrs. Sadie M. Fosgate, Ashburnham. |
| Ashfield, No. 69, | Herbert L. Clark, Ashfield, R. F. D. | Mrs. S. H. Boice, South Ashfield. | Mrs. Joseph Tatro, Shelburne Falls, R. F. D. |
| Ashland, No. 124, | Charles Stone, Ashland. | Mrs. Lizzie F. Bennett, Box 197, Ashland. | Mrs. C. E. Burr, Box 21, Ashland. |
| Athol, No. 175, | Mrs. S. Ella Southland, Athol. | George Marshall, Athol. | Sarah L. Smith, Athol. |
| Auburn, No. 60, | Charles A. Stone, 22 Hollywood St., Worcester. | William Gilbert, Auburn. | Miss Maud B. Seaton, Auburn. |
| Baldwinville, No. 249, | John H. Putnam, Baldwinville. | Miss Katherine Dunn, Baldwinville. | Miss Alta V. Lund, Baldwinville. |
| Barre, No. 9, | Edwin C. Hunt, Bogue. | Mrs. Ethel E. Cleveland, Barre Plains. | James M. Washburn, Barre. |
| Becket, No. 47, | Howard R. Molineux, Becket. | Mrs. C. E. Lyman, Becket. | R. A. Spencer, Becket. |
| Bellingham, No. 190, | Charles S. Carter, Caryville. | Henry A. Whitney, Bellingham. | Ada H. Greenwood, Box 95, Milford. |
| Berlin, No. 134, | Albert E. Jacobs, Clinton. | Miss Frances E. Rice, Berlin. | I. Edmund Coulson, Berlin, R. F. D. |
| Bernardston, No. 81, | F. W. Putnam, Bernardston. | Mrs. R. H. Cushman, Bernardston. | Miss Carrie M. Slate, Bernardston. |
| Billerica, No. 223, | T. Emery Smith, Billerica. | Walter Morris, Billerica. | Mrs. Cora Baker, Billerica. |
| Blandford, No. 24, | Albert H. Nye, Blandford. | P. A. Shurtleff, M.D., Blandford. | M. J. Raymond, Blandford. |
| Bolton, No. 142, | Arthur D. Whitcomb, Stow, R. F. D. | Rev. E. C. Headle, Bolton, R. F. D. | Mrs. G. L. Taylor, Hudson. |
| Boxborough, No. 131, | L. W. Richardson, West Acton. | Mrs. Albert Littlefield, West Acton. | Miss Carrie G. Bradford, West Acton. |
| Boylston, No. 111, | William S. Garfield, Boylston. | Mrs. Annie R. Benson, Boylston Centre. | Mrs. A. B. Brosseae, Boylston. |
| Bradford, No. 238, | Howard Kimball, Ward Hill, R. F. D. | Mrs. L. G. Haskell, Main St., Haverhill. | Miss Sarah B. Barnes, 200 Boardman St., Haverhill. |

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| Braintree, No. 262, | Josephus Sampson, Braintree. | Joseph G. Spear, East Braintree. | Mrs. Salome C. Sanford, South Braintree. |
| Brewster, No. 272, | L. A. Crocker, Brewster. | Rev. E. A. Chase, Brewster. | H. F. Bates, Brewster. |
| Brimfield, No. 65, | Clarence B. Brown, Brimfield. | Clarence B. Brown, Brimfield. | Mrs. B. A. Garms, Brimfield. |
| Brookfield, No. 174, | Miss Abbie J. Thompson, Brookfield, R. F. D. | Mrs. Jennie L. Bemis, Brookfield. | Mrs. Lottie F. Clark, Brookfield. |
| "Brookville" of Holbrook, No. 197. | James A. Stowers, Holbrook. | Mrs. Meriel Stowers, Holbrook. | Miss Hattie L. Shaw, 433 Howard St., Brockton. |
| Buckland, No. 87, | Eugene D. Griswold, Buckland. | Mrs. F. L. Warfield, Buckland. | Mrs. H. B. Wells, Shelburne Falls. |
| Carlisle, No. 258, | James S. Anthony, Carlisle. | Mrs. Lucy R. Davis, Carlisle. | Miss Grace Chamberlain, Carlisle. |
| Charlemont, No. 66, | C. A. Hawkes, Charlemont. | D. J. Davenport, Charlemont. | Miss Anna M. Porter, Charlemont. |
| Charlton, No. 92, | Edward M. Bowers, Charlton. | Mrs. Ida Taylor, Dodge, R. F. D. | Mrs. Rosa E. Bowers, Charlton. |
| Chelmsford, No. 244, | Francis O. Dutton, Chelmsford. | Mrs. F. J. Spaulding, 32 Grace St., Lowell. | Harlan A. Knowlton, Chelmsford. |
| Cheshire, No. 17, | J. C. Jenks, Adams, R. F. D. | Mrs. J. G. Bennett, Cheshire. | Mrs. Maude L. Purdy, Cheshire. |
| Chicopee, No. 211, | Arthur Megargel, 254 Chicopee St., Chicopee. | Miss Jennie I. Brill, Chicopee. | Mrs. Edna S. Herrick, 254 Chicopee St., Chicopee. |
| Chilmark, No. 255, | Edy C. Flanders, Chilmark. | Mrs. Celia Dean, Chilmark. | Miss Leona B. Mitchell, Chilmark. |
| Cochituate, No. 229, | Fred Whitehouse, Wellesley. | Frederick H. Fowler, Wayland. | Mrs. Gertrude D. Bishop, Cochituate. |
| Colrain, No. 76, | Frank Cromack, Elm Grove. | Mrs. C. L. Brigham, Colrain. | Miss Bessie M. Kemp, Colrain. |
| Concord, No. 150, | Franklyn C. Farley, Concord. | Mrs. A. C. Jones, Concord. | Arthur B. Worthley, Concord. |
| Conway, No. 8, | L. T. Hopkins, Conway, R. F. D. | Mrs. L. T. Hopkins, Conway, R. F. D. | Mrs. J. H. Antes, Conway. |
| Cummington, No. 56, | Denison C. Morey, Cummington. | Roland E. Bates, Swift River. | Mrs. W. A. Huston, Cummington. |
| Dalton, No. 23, | James E. Bardin, Dalton. | Mrs. J. J. Glynn, Dalton. | F. N. Groesbeck, Dalton. |
| Danvers, No. 263, | Charles H. Preston, Hathorne. | Geo. W. Towne, Hathorne. | N. Perley Clark, Danvers. |
| Dartmouth, No. 162, | J. F. Briggs, Dartmouth. | Mrs. Alice Davoll, Dartmouth. | Mrs. Hannah A. Briggs, Dartmouth. |
| Deerfield, No. 3, | Lewis J. Smith, Deerfield. | Miss Kathryn Slocombe, Deerfield. | P. G. Davis, Deerfield. |
| Dennis, No. 260, | Joshua Crowell, East Dennis. | Frank E. Howes, Dennis. | Nathan Crowell, East Dennis. |
| Dover, No. 117, | Granville Perkins, Needham, R. F. D. | Mrs. Inez M. Packard, Needham, R. F. D. | Mrs. Marian B. Chickering, Dover. |
| Dracut, No. 216, | Herbert C. Jones, Lowell, R. F. D., No. 2. | Mrs. Ada M. Fox, Lowell, R. F. D., No. 2. | S. Howard Chace, 97 18th St., Lowell. |
| Dudley, No. 163, | Frank S. Walker, Dudley. | Dyer S. Elliott, N. Grosvenordale, Conn. | Miss R. D. Vinton, Dudley. |
| East Blackstone, No. 137, | Addie M. Stearns, East Blackstone, R. F. D. | Sabra Bennett, East Blackstone, R. F. D. | May V. Sargent, East Blackstone, R. F. D. |

MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

| NAME. | MASTER. | LECTURER. | SECRETARY. |
|---|---|---|---|
| East Charlemont, No. 261, | A. P. Goldthwait, East Charlemont. | Mrs. L. L. Ball, East Charlemont. | Miss Inez G. Temple, East Charlemont. |
| Easthampton, No. 27, | G. L. McEvoy, Lock Box 1544, Easthampton. | Mrs. W. A. Root, Easthampton. | Miss Lillian A. Russell, Easthampton. |
| East Longmeadow, No. 152, | Herman W. King, East Longmeadow. | Robert Delehanta, East Longmeadow. | Mrs. K. Adella Wood, E. Longmeadow. |
| "East Medway" of Millis, No. 112. | Herbert H. Thorne, Millis. | George P. Holbrook, Millis. | Howard A. Payson, Millis. |
| East Princeton, No. 219, | Elmer Merriam, East Princeton. | Mrs. Rose Lucas, East Princeton. | Alwilda Drury, Princeton. |
| East Sandwich, No. 139, | S. F. Crocker, East Sandwich. | Mrs. Sadie J. Holway, Spring Hill. | Rosa S. Armstrong, East Sandwich. |
| Easton, No. 196, | Harry C. Marshall, North Easton. | William N. Craig, North Easton. | Mrs. Emily M. Drew, 11 Grafton St., Brockton. |
| Egremont, No. 63, | E. R. Peck, Great Barrington, R. F. D., No. 1. | Mrs. Mary H. Dunlap, Great Barrington, R. F. D., No. 3. | E. A. Tyrrell, Great Barrington, R. F. D., No. 3. |
| Enfield, No. 243, | Harry L. Ryther, Enfield. | Mrs. A. J. N. Ward, Enfield. | Miss Jennie P. Dodge, Enfield. |
| Everett, No. 250, | Mrs. Emma H. Colburn, 224 Hancock St., Everett. | Mrs. Mary F. Wheeler, Everett. | C. E. Dinslow, 44 High St., Everett. |
| Fitchburg, No. 186, | R. W. Grubb, Fitchburg, R. F. D., No. 2. | Mrs. Edith F. Andrews, Fitchburg, R. F. D., No. 1. | Mrs. Mabelle C. Hill, 64 Academy St., Fitchburg. |
| Foxborough, No. 193, | Wm. E. Perkins, Foxborough. | Francis Daniels, Foxborough. | Mrs. Aurelia L. Dupee, Foxborough. |
| Framingham, No. 113, | J. M. Harrington, South Framingham, R. F. D., No. 3. | J. W. Jones, S. Framingham, R. F. D., No. 2. | Geo. E. Fay, S. Framingham, R. F. D., No. 2. |
| Franklin, No. 144, | John S. Mackintosh, Franklin. | Mrs. John L. Fisher, Wrentham. | Mrs. Alice A. Duprez, 42 East St., Franklin. |
| Gardner, No. 130, | Frank F. Curtis, Sr., East Templeton. | Mrs. Mary A. Stone, Gardner. | Miss Mabel B. Cornwall, Gardner. |
| "Garfield" of No. Dana, No. 104, | Mrs. Abbie Whitney, Dana. | Mrs. Emma Kendall, North Dana. | R. N. Doubleday, North Dana. |
| "Golden Rule" of Prescott, No. 52. | Wm. H. Petrie, Greenwich Village, R. F. D., No. 1. | Mrs. Fanny G. Thayer, Greenwich Village. | Howard I. Shaw, Greenwich Village, R. F. D. |
| Granby, No. 157, | C. N. Rust, Granby. | Miss Myra E. Chapin, Granby. | Mrs. W. F. Howard, Granby. |
| "Granite" of South Worthington, No. 49. | Rufus H. Adams, Ringville. | Mrs. Hattie Thrasher, S. Worthington. | Mrs. Mabel C. Smith, Ringville. |

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| Grafton, No. 93, | Silas B. Goddard, Grafton. | J. Frank Johnson, North Grafton. | Mrs. Eva M. Sibley, Grafton, R. F. D. |
| Granville, No. 40, | S. B. Root, Granville. | Mrs. Harry Hartley, Granville. | R. G. Hires, Granville. |
| Great Barrington, No. 256, | Harold M. Shaw, Housatonic, R. F. D. | C. W. Freehan, Great Barrington. | D. Fay Whitcomb, Great Barrington. |
| "Green River" of Williamstown, No. 159. | Frank H. Stanton, Williamstown. | Mrs. Leroy B. Smith, Williamstown. | Mrs. Harriet M. Knell, Williamstown. |
| Greenwich, No. 245, | F. E. Alden, Greenwich Village. | Mrs. Fannie Johnson, Greenwich Village. | Mrs. Jennie E. Lincoln, Greenwich Village. |
| Groton, No. 7, | William A. Wood, Groton. | Mrs. Georgie Mason, Ayer. | Miss Hattie Woods, Groton. |
| Groveland, No. 237, | Howard L. Webber, 32 Mechanic St., Haverhill. | Miss Mabelle M. Brown, 11 Broad St., Groveland. | Miss Bessie P. Brown, 11 Broad St., Groveland. |
| "Guiding Star" of Greenfield, No. 1. | F. A. Cowan, Leyden Road, Greenfield. | Dr. Daniel Griffin, Greenfield. | Mrs. Grace M. Hinckley, 63 Wells St., Greenfield. |
| Halifax, No. 253, | C. E. Devitt, Halifax. | N. S. Guptill, Bridgewater, R. F. D. | Mrs. Ellen P. Thompson, Halifax. |
| Hardwick, No. 67, | A. FitzRandolph, Hardwick. | Miss A. D. Knight, Gilbertville. | Mrs. W. E. Goddard, Hardwick. |
| "Harmony" of Easton, No. 247, | Roscoe W. Melindy, South Easton. | Miss Carrie A. Keith, Easton. | Mrs. Jennie McNamara, Easton. |
| Harvard, No. 149, | Chas. L. Clay, Harvard. | Miss Emeline Knight, Harvard. | Henry A. Knight, Harvard. |
| Haverhill, No. 154, | Adelbert H. Adams, 51 Broadway, Haverhill. | Hattie D. Hall, Ayers Village. | Grace A. Merrill, 1231 Broadway, Haverhill. |
| Heath, No. 227, | Hugh L. Thompson, Heath. | Mrs. J. W. Stetson, Heath. | Miss Mary C. Burrington, Heath. |
| "Highland" of Huntington, No. 48. | Edwin D. Cady, Huntington. | Mrs. E. D. Cady, Huntington. | Jos. G. Oliver, Huntington. |
| "Hill Top" of Windsor, No. 267, | J. A. Estes, Windsor. | Mrs. Florence Cady, Windsor. | H. J. Whitmarsh, Windsor. |
| Hinsdale, No. 19, | A. N. Warren, Hinsdale. | Mrs. Minnie Wilson, Hinsdale. | W. E. Morgan, Hinsdale. |
| Holden, No. 78, | Hermon E. Moore, Holden. | Mrs. S. N. Hubbard, Holden. | Mrs. C. M. Stanhope, Holden. |
| Holliston, No. 115, | Warren Coolidge, Holliston. | Miss Mary E. Cutler, Holliston. | Mrs. Nellie V. Pope, Holliston. |
| "Hope" of Hadley, No. 15, | F. P. Wheeler, Hadley. | Mrs. Henry E. Smith, Hadley. | Mrs. J. W. Marsh, Hadley. |
| Hopkinton, No. 173, | Harold O. Day, Hopkinton. | Miss Anna M. Fryberg, Hopkinton. | Mrs. Sadie Peaslee, Woodville. |
| Hubbardston, No. 126, | William E. Clough, Hubbardston. | Miss Mable I. Smith, Hubbardston. | Bessie A. Shaw, Hubbardston. |
| Hudson, No. 108, | Percy R. Coldwell, Hudson, R. F. D. | Miss Annie J. Quinn, Hudson. | Mrs. Mary E. Lawrence, 55 Lincoln St., Hudson. |
| Lancaster, No. 120, | J. Fred Brown, South Lancaster. | A. J. Kennedy, Lancaster. | Mrs. Foster L. Sawyer, Lancaster. |
| Lanesborough, No. 21, | W. E. Foster, Lanesborough. | Miss E. Tollotson, Lanesborough. | Ella A. Miner, Lanesborough. |

### MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

| NAME. | MASTER. | LECTURER. | SECRETARY. |
|---|---|---|---|
| "Laurel" of West Newbury, No. 161. | Arthur J. Brooks, North Atkinson St., Newburyport. | Mrs. Belle Bunker, Prospect St., Newburyport. | Chas. F. Brown, Prospect St., Newburyport. |
| Lee, No. 88, | C. H. Shaylor, Lee. | Mrs. W. A. Dikeman, Lee. | Mrs. W. M. Shaylor, Lee. |
| Leominster, No. 198, | Wm. J. Nutting, North Leominster. | Mrs. W. J. Nutting, Leominster. | Miss Lilla Robbins, 184 Main St., Leominster. |
| Lexington, No. 233, | Howard M. Munroe, Lexington. | Wm. A. Staples, Lexington. | Miss Bertha E. Whitaker, Lexington. |
| Leyden, No. 71, | H. W. Severance, Bernardston. | M. E. Severance, Bernardston. | Chas. E. Severance, Bernardston. |
| Littleton, No. 188, | George H. Cash, Concord Junction, R. F. D. | Mrs. Grace D. Cash, Concord Junction, R. F. D. | Miss Elizabeth Robbinson, Littleton Common. |
| Ludlow, No. 179, | Edward E. Chapman, Ludlow. | Mrs. Lemont Cassidy, Ludlow Centre. | Miss Mabel Johnson, Ludlow. |
| Lunenburg, No. 169, | Arthur Q. Emerson, Lunenburg. | Miss Ethel E. Emerson, Lunenburg. | James Hildreth, Lunenburg. |
| "Manhan" of Southampton, No. 82. | Miss Julia E. Norris, Southampton. | C. S. Hooker, Holyoke, R. F. D., No. 16. | L. Augusta Gridley, Southampton. |
| Marlborough, No. 105, | H. F. Wilder, Marlborough. | F. H. Brown, Marlborough, R. F. D. | Mrs. E. D. Howe, Marlborough. |
| Mattapoisett, No. 215, | Dr. I. N. Tilden, Mattapoisett. | Miss Ella A. Madden, Mattapoisett. | Mrs. Alice W. Ashby, Mattapoisett. |
| Medfield, No. 114, | George R. Steere, Medfield. | Turner R. Bailey, Medfield. | Mrs. W. W. Preston, Medfield. |
| Mendon, No. 143, | Freeman C. Lowell, Mendon. | Frank H. Wood, Mendon. | Herbert J. George, Mendon. |
| Merrimac, No. 171, | Edwin C. Walker, Merrimac, R. F. D. | George B. Crofut, Merrimac, R. F. D. | Mrs. E. C. Walker, Merrimac, R. F. D. |
| Methuen, No. 155, | F. O. Wheeler, Salem, N. H., R. F. D. | Mrs. Sylvia C. Hill, Methuen. | Frank A. Gordeon, 96 Arnold St., Methuen. |
| Milford, No. 271, | Chester L. Clark, Milford. | Charles W. Haley, Milford. | Minnie B. Wilcox, South Milford. |
| Millbury, No. 107, | Henry W. Carter, Millbury. | Fred H. Rice, Box 894, Worcester. | James W. Robertson, Box 43, Millbury. |
| "Miller's River" of Orange, No. 176. | Wm. C. Kidder, 15 Dexter St., Orange. | May Lunt, 288 E. Main St., Orange. | Mrs. Ella J. Keith, 30 Terrace St., Orange. |
| "Mill River" of New Marlborough, No. 269. | W. S. Bradley, Southfield. | Mrs. Effie M. Karner, Mill River. | Mrs. Lena M. Lockwood, Southfield. |
| "Milton" of North Attleborough, No. 185. | D. B. Hunt, North Attleborough, R. F. D. | Frank McGinity, South Attleborough. | Miss Ruth E. Hunt, N. Attleborough, R. F. D. |

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| Montague, No. 141, | W. H. Ripley, Montague. | Mrs. R. N. Hayden, Montague. | Miss Nellie Rist, Montague. |
| Montgomery, No. 45, | Walter D. Allyn, Montgomery. | Lucien O. Moore, Montgomery. | Florence B. Moore, Montgomery. |
| "Nemasket" of Middleborough, No. 158. | L. B. Twitchell, Middleborough. | Mrs. L. B. Twitchell, Middleborough. | A. D. Deane, Middleborough. |
| New Braintree, No. 170, | Edwin L. Havens, New Braintree. | Miss Mary F. Pollard, New Braintree. | Mrs. Ida M. Havens, New Braintree. |
| Newbury, No. 234, | Fred W. Chase, 24 Summit Place, Newburyport. | Mrs. Lucy L. Ilsley, Newburyport. | Miss Marcia E. Little, 4 Green St., Newbury. |
| New Lenox, No. 26, | Harry H. Sears, New Lenox. | Mrs. Harvey H. Dewy, New Lenox. | Harvey H. Dewy, New Lenox. |
| New Salem, No. 256, | Frederic F. Ballard, Millington. | Mrs. Ella O. Marshall, New Salem. | Miss Mary A. Carpenter, Millington. |
| Norfolk, No. 135, | Wm. A. Day, Norfolk. | Percival R. Eaton, Norfolk. | Mrs. Emma F. Holbrook, Norfolk. |
| Northampton, No. 138, | S. S. Warner, Florence. | E. I. Clapp, Northampton. | Ida A. Fuller, 39 Graves Ave., Northampton. |
| North Andover, No. 128, | Albert Currier, North Andover. | Mrs. Francis T. Wilson, North Andover. | Walter H. Hayes, North Andover. |
| Northborough, No. 119, | John W. Allen, Northborough. | Mrs. Bertha Poland, Northborough. | E. M. Cutler, Northborough. |
| North Brookfield, No. 132, | Eugene E. McCarthy, North Brookfield. | Mrs. Carrie A. Doane, North Brookfield. | Miss Jennie E. Doane, North Brookfield. |
| Northfield, No. 3, | T. R. Callender, Northfield. | Kate G. Alexander, Northfield. | Mrs. M. E. Callender, Northfield. |
| North Orange, No. 86, | Wm. A. Taylor, North Orange. | Mrs. Daisy L. White, North Orange. | Golan A. Miller, North Orange. |
| North Reading, No. 239, | Arthur E. Abbott, Reading. | Rev. J. H. Hoffman, North Reading. | Miss Annie B. Hogan, North Reading. |
| Norton, No. 218, | Chas. G. Clapp, Norton. | Miss Susan M. Barker, Norton. | Miss Laura F. Barker, Norton. |
| Oakham, No. 235, | John W. Dwelly, Oakham. | Mrs. Minnie G. Woodis, Oakham. | Mrs. Lilla Robinson, Oakham. |
| "Oak Hill" of Attleborough, No. 212. | Charles W. Deane, Attleborough, Mass. | Mrs. E. V. Carpenter, Attleborough. | Mrs. M. P. Smith, Attleborough, R. F. D., No. 4. |
| Oxford, No. 123, | D. M. Howe, Oxford. | Miss A. Maud Townsend, Oxford, R.F.D. | L. H. Cudworth, Oxford. |
| Palmer, No. 241, | Joseph T. Geer, Three Rivers. | Miss Anna M. Wells, Palmer. | Mrs. Bessie Grimstone, Palmer, R. F. D. |
| Peru, No. 266, | Harvey L. Hadlock, Peru. | Mrs. F. G. Creamer, Peru. | Mrs. H. A. Frissell, Peru. |
| Petersham, No. 95, | Benjamin E. Cook, Petersham. | Mrs. Jennie Stone, Petersham. | Mrs. Adelaide M. Wilder, Petersham. |
| Phillipston, No. 70, | Walter White, Phillipston. | Mrs. Mary R. Chaffin, Phillipston. | Mrs. Cora A. Dunton, Phillipston. |
| Pittsfield, No. 14, | John H. Noble, 309 Holmes Road, Pittsfield. | Mrs. W. D. Crosier, Pittsfield. | Miss Alta B. Foote, 564 Elm St., Pittsfield. |
| Plainfield, No. 232, | Chas. A. Williams, Plainfield. | Mrs. E. S. Gloyd, Plainfield. | Miss Hattie G. Parker, Plainfield. |
| "Ponkapoag" of Canton, No. 231, | Joseph W. Farwell, Ponkapoag. | Miss Isabelle C. McIntire, Mattapan. | Mrs. Nettie F. Farwell, Ponkapoag. |
| "Prescott" of Pepperell, No. 73, | Fred S. Bancroft, Pepperell. | Miss Sarah B. Tucker, Pepperell. | Miss S. Luella Parker, East Pepperell. |

## MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

| NAME. | MASTER. | LECTURER. | SECRETARY. |
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| "Quascacunquen" of Byfield, No. 236. | Benj. P. Towne, Rowley, R. F. D. | Chas. O. Bailey, Byfield. | Miss Jessie N. Towne, Rowley, R. F. D. |
| "Quinobequin" of Medway, No. 264. | Thos. F. Malloy, Medway. | Orion T. Mason, Medway. | J. M. Parker, Medway. |
| Richmond, No. 32, . . . . | Frank Barnes, Richmond. | Jesse H. Fairfield, Jr., Richmond. | Ida H. Barnes, Richmond. |
| Rochester, No. 257, . . . . | Allen G. Ashley, Marion, R. F. D. | George L. Randall, Marion, R. F. D. | Mrs. Annie B. M. Cowen, Rock, R. F. D. |
| Rowe, No. 167, . . . . | Henry D. Wright, Rowe. | Wayne D. Wood, Rowe. | Anna L. Henry, Rowe. |
| Rowley, No. 204, . . . . | George F. Carleton, Rowley, R. F. D., No. 1. | Mrs. Hannah M. Mooney, Rowley. | J. A. Marshall, Rowley. |
| Royalston, No. 195, . . . . | C. E. Richardson, Royalston. | C. A. Stimson, Athol, R. F. D. | E. M. Stockwell, Royalston. |
| Rutland, No. 242, . . . . | Mark A. Putnam, Rutland. | Louis M. Hauff, Rutland. | Mrs. Alice M. Wales, Rutland. |
| Salisbury, No. 228, . . . . | Winifred M. Pike, Salisbury. | William Evans, Salisbury. | Miss Frances Bragg, Salisbury. |
| Savoy, No. 99, . . . . . | F. N. Haskins, Savoy. | Mrs. William McCulloch, Savoy. | L. E. Flanders, Savoy. |
| Sheffield, No. 224, . . . . | Edwin H. Cande, Sheffield. | Isaac Kelsey, Sheffield, R. F. D., No. 1. | Z. H. Cande, Sheffield. |
| Shelburne, No. 68, . . . . | D. P. Bardwell, Bardwells. | Mrs. C. O. Loomis, Greenfield. | Mrs. W. J. Purrington, Shelburne. |
| Sherborn, No. 110, . . . . | Oscar H. Howe, South Sherborn. | E. C. Barber, Sherborn. | Annie H. Daniels, South Sherborn. |
| Shirley, No. 254, . . . . | Fred. A. Holden, Shirley. | Mrs. Flora A. Holden, Shirley. | H. F. Grout, Shirley Center. |
| Shrewsbury, No. 101, . . . | Charles W. Watts, Shrewsbury. | Mrs. Lewis E. Gates, Shrewsbury. | Mrs. Emily A. Carey, Shrewsbury. |
| Shutesbury, No. 273, . . . | Rev. A. G. Littlefield, Shutesbury. | Miss Minnie M. Morrison, Shutesbury. | Miss Nettie A. Rogers, Shutesbury. |
| Somerset, No. 168, . . . . | Frank Hathaway, Pottersville. | Mrs. Mary Rice, Somerset. | Miss Lois A. Davis, Somerset, R. F. D. |
| Southborough, No. 118, . . . | Arthur A. Phelps, Southborough. | Christian Duncan, Southborough. | Waldo A. Fay, Southborough. |
| Southbridge, No. 182, . . . | Roland H. Gilbert, Southbridge. | Jennie S. Gilbert, Southbridge. | Adella Hare, 32 Main St., Southbridge. |
| South Hadley, No. 160, . . . | E. M. Burnette, South Hadley. | Mrs. L. I. Alvord, South Hadley, R. F. D. | I. N. Day, South Hadley. |
| South Weymouth, No. 270, . . | Horace W. Spear, South Weymouth. | Clarence W. Fearing, South Weymouth. | Louis A. Cook, Jr., South Weymouth. |
| Southwick, No. 46, . . . . | Nelson J. Trench, Southwick. | Mrs. F. D. Lambson, Southwick. | Mrs. N. J. Trench, Southwick. |
| Spencer, No. 79, . . . . | Elmer E. Bacon, Spencer. | J. R. Kane, Spencer. | J. W. Bigelow, Spencer. |
| Springfield, No. 54, . . . . | E. W. Barney, 388 N. Main St., Springfield. | Mary P. Nettleton, Springfield. | F. Belle Barney, 388 N. Main St., Springfield. |
| Sterling, No. 53, . . . . | Fred R. Trask, Pratt's Junction. | Mrs. Joseph R. Graham, Pratt's Junction. | Robert P. Trask, Pratt's Junction. |

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| Stoughton, No. 199, | Charles F. Curtis, Stoughton. | Mrs. Herbert Mosman, Stoughton. | Mrs. Jennie M. Spaulding, Stoughton. |
| Stow, No. 103, | Chas. A. Hearsey, Gleasondale. | J. S. Moulton, Stow. | Mrs. N. S. Lewis, Stow. |
| Sturbridge, No. 177, | Ernest G. Barnes, Sturbridge. | Mrs. Geo. W. Edgerly, Sturbridge. | Mrs. Mabel Nichols, East Brookfield, R. F. D. |
| Sudbury, No. 121, | Thomas F. O'Neill, Maynard, R. F. D. | Mrs. S. Josephine White, Sudbury. | Miss Angie M. Bent, Sudbury. |
| Sunderland, No. 220, | Dr. M. H. Williams, Sunderland. | George P. Smith, Sunderland. | Miss Adaline M. Clark, Sunderland. |
| Sutton, No. 109, | C. A. Hough, Sutton, R. F. D. | F. H. Benedict, Sutton, R. F. D. | Miss Sarah M. Mills, Sutton, R. F. D. |
| Taunton, No. 230, | Wm. M. Burton, 175 County St., Taunton. | Wm. Lamson, Bridgewater. | Geo. A. Lincoln, Walker St., Taunton. |
| Templeton, No. 122, | H. H. Seaver, Templeton. | J. A. Braithwaite, Templeton. | Mrs. R. S. Titterton, Templeton. |
| Tewksbury, No. 207, | Mrs. E. P. Streckwall, Tewksbury Centre. | Miss Edith Haines, No. Billerica, R. F. D., No. 1. | Miss S. C. Whittemore, Tewksbury Centre. |
| "Thrifty" of Leverett, No. 37, | Henry M. Collis, Leverett. | C. H. Beeman, Leverett. | F. N. Bourne, North Leverett. |
| Topsfield, No. 184, | Archie A. Towne, Topsfield. | Gertrude Bradstreet, Topsfield. | Charles F. Averill, Topsfield. |
| Townsend, No. 194, | Mrs. Abbie A. Barber, Townsend. | Mrs. Emma F. Seaver, Townsend. | George A. Wilder, Townsend. |
| Tyngsborough, No. 222, | C. P. Littlehale, Tyngsborough. | Mrs. W. A. Sherburne, Tyngsborough, R. F. D. | Miss Lottie Upton, Tyngsborough. |
| "Union" of Belchertown, No. 64, | E. A. Randall, Belchertown. | Miss Rosabelle M. Olds, Belchertown. | Mrs. E. J. Freeman, Belchertown. |
| Upton, No. 125, | T. F. Boyd, West Upton. | Miss Myrtice S. King, Upton. | Mrs. L. Jennie Chapman, West Upton. |
| Uxbridge, No. 200, | M. L. Goldthwaite, Uxbridge. | Mrs. Kate Thom, Uxbridge. | Mrs. H. G. Ramsey, Uxbridge. |
| "Wachusett" of Leominster, No. 252. | J. H. Johnson, 404 West St., Leominster. | Mrs. Grace Lee Abbott, Leominster. | Manley G. Hatstat, Union St., Leominster. |
| Walpole, No. 214, | Dwight H. Smith, Walpole. | Edmund Grover, East Walpole. | Mrs. Carrie C. Snyder, Walpole. |
| Ware, No. 164, | Edgar D. Winslow, Ware. | Mrs. Angie G. Buffington, Ware. | Mrs. Emma J. Howard, Ware, R. F. D., No. 1. |
| Warren, No. 189, | Alfred A. Warriner, Warren. | John W. Williams, Warren. | Mrs. Alice M. Bliss, Warren. |
| Warwick, No. 85, | W. L. Mann, Warwick. | Mrs. Etta M. Bass, Warwick. | G. A. Witherell, Warwick. |
| "Webster" of Marshfield, No. 205, | Alpheus H. Walker, Millbrook. | Henry P. Moulton, Duxbury. | Frank T. Harlow, Marshfield Hills. |
| Wellesley, No. 166, | Joseph Mason, Waban. | Henry M. Howard, West Newton. | Mrs. Chas. Cartwright, 12 Brook St., Wellesley. |
| Wendell, No. 248, | C. M. Ballou, Wendell. | Mrs. Nellie Morgan, Wendell. | Mrs. Bessie Stafford, Wendell. |
| Westborough, No. 116, | W. T. Herrick, Westborough. | Mrs. Maria A. Gilmore, Westborough, R. F. D., No. 2. | Mrs. Julia H. Rogers, Westborough, R. F. D., No. 2. |

MASSACHUSETTS PATRONS OF HUSBANDRY — *Concluded.*

| NAME. | MASTER. | LECTURER. | SECRETARY. |
|---|---|---|---|
| West Boxford, No. 140, | George P. Webster, Ward Hill, R. F. D., No. 1. | Mrs. Eliza C. Carver, West Boxford. | Miss Matilda B. Lund, West Boxford, R. F. D. |
| West Bridgewater, No. 156, | Murry R. Tuttle, Campello. | Eddy P. Dunbar, W. Bridgewater. | Miss Rhoda F. Wilbur, W. Bridgewater. |
| West Brookfield, No. 180, | Mrs. Nellie H. L. Canterbury, W. Brookfield. | Mrs. Clara L. Haskins, West Brookfield. | Mrs. Sarah Carter, West Brookfield. |
| Westfield, No. 20, | A. L. Sanborn, Westfield. | Mrs. C. M. Gardner, Westfield. | Miss Annette Sackett, Westfield. |
| Westford, No. 208, | John P. Wright, Westford. | Mrs. C. A. Reid, Westford, R. F. D., No. 1. | Mrs. F. C. Wright, Westford, R. F. D., No. 1. |
| Westminster, No. 203, | Frank E. Derby, Westminster Centre. | Fred G. Parcher, Westminster Centre. | Lizzie E. Baker, Westminster, R. F. D. |
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# TWENTIETH ANNUAL REPORT

OF THE

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# AGRICULTURAL EXPERIMENT STATION.

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OF THE

# MASSACHUSETTS AGRICULTURAL COLLEGE,

AMHERST, MASS.

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| ROY F. GASKILL, | *Assistant in Animal Nutrition.* |
| CARL S. POMEROY, PH.B., | *Assistant Horticulturist.* |
| EDWIN F. GASKILL, B.Sc., | *Assistant Agriculturist.* |
| T. A. BARRY, | *Observer.* |

# REPORT OF THE DIRECTOR.

The work of the Massachusetts Agricultural Experiment Station during the past year has in the main followed the usual lines, but in most directions with constantly broadening scope and material increase in amount. The completion of Clark Hall, which will amply accommodate both the educational and the experimental work in the department of botany and vegetable pathology, will materially increase our facilities for investigation in this subject; but the interruption to work, made unavoidable by the necessity of moving and reinstalling the large amount of scientific apparatus and material, has necessarily reduced the amount of work in this department during the past year. The interruption has proved especially serious in connection with the study of problems relating to hothouse crops, as such work on the removal of department headquarters was necessarily discontinued in the old houses, and the new will not be completed until next spring. With this single exception, the work in all departments of the station has been prosecuted under conditions affording all the usual advantages.

## Changes in Organization and in Staff.

The retirement from active administrative duties on the 1st of July of Dr. C. A. Goessmann, who from the date of its passage in 1884 has been charged with the execution of the fertilizer control law, and who was at the head of that branch of our chemical department carrying on general analytical and research work in connection with soils, manures, fertilizers and fertilizer problems, rendered reorganization in that department desirable. The chemical work of the station during the preceding eleven years had been divided between two distinct and entirely independent divisions, and carried on in separate laboratories. These divisions were known as the division of fertilizers and fertilizer materials and the division of foods and feeding; the first, as has been stated, under Dr. C. A. Goessmann, and the second in charge of Dr. J. B. Lindsey. It was believed that organization under one head would secure a number of important advantages, as compared with the existing plan. Most important among the advantages which we have aimed to secure in reorganization were the following: —

1. Greater administrative economy.
2. Reduction in cost of equipment, apparatus and work.
3. The more complete separation of control from ordinary experimental and research work, thus making possible more accurate determination of the costs of each.
4. Improved facilities for research work in chemistry, through the creation of a research division, to which certain specially qualified men should give their entire time.
5. A saving in the time required for certain classes of control and analytical work, through concentration of forces alternately upon different branches of such work.

The organization adopted in the effort to realize these advantages is as follows: —

*Department of Plant and Animal Chemistry.*

Chemist: J. B. Lindsey, Ph.D.
Associate Chemist: E. B. Holland, M.S.
(*a*) Research division: E. B. Holland, M.S.
(*b*) Fertilizer division: H. D. Haskins, B.Sc.
(*c*) Feed and dairy division: P. H. Smith, B.Sc.

Besides the heads of divisions, four other analytical chemists, an inspector who collects samples of feeds and fertilizers and inspects dairy apparatus, a general laboratory assistant and one or sometimes two clerical assistants, one of whom is an expert stenographer, are regularly employed. The department also employs an assistant, who cares for the animals used in nutrition experiments and digestion work.

The chemist has general supervision of the entire work, and is responsible therefor, but is relieved of details, and will give most of his time to research problems. The associate chemist assists the chemist if required, or in his absence acts in his stead. The associate chemist, whose duties as such are usually nominal, was placed at the head of the research division. Mr. Holland, who received this appointment, had already had much and successful experience in chemical investigation.

Mr. Haskins, who was put in direct charge of the fertilizer control, with responsibility to the chemist, has for several years been looking after most of the details of this line of work, owing to the advanced age of Dr. Goessmann, and is well qualified for the position, both by training and experience.

Mr. Smith, who, with responsibility to the chemist, was put in charge of the feed and dairy control division, had had several years of experience in such work, for which he had shown especial fitness.

No other changes in organization have been made during the year, and the station at the present time makes provision for the various lines of work in which it engages under the following departmental organization: —

| *Departments.* | *Heads of Departments.* |
|---|---|
| Agriculture, | The Director. |
| Horticulture, | F. A. Waugh, M.S. |
| Plant and animal chemistry, | J. B. Lindsey, Ph.D.<br>E. B. Holland, M.S., associate. |
| Botany and vegetable pathology, | G. E. Stone, Ph.D. |
| Entomology, | C. H. Fernald, Ph.D.<br>H. T. Fernald, Ph.D., associate. |
| Veterinary, | J. B. Paige, D.V.S. |
| Meteorology, | J. E. Ostrander, C.E. |

The only change in staff affecting a position of prominence in the station during the past year has been the retirement of Dr. Goessmann from active administrative duties at the head of the fertilizer division of our chemical department, already referred to. The station is fortunate in still being able to avail itself of Dr. Goessmann's services in the capacity of consulting chemical expert. His broad chemical knowledge and richly cultured mind and his long and varied experience render his advice of great value.

Dr. Goessmann at the age of eighty years looks back upon a career the memory of which must be to him a source of unusual satisfaction. It excites the profound admiration of all those familiar with his life, his character and his achievements. The exercises held at the college last commencement in honor of his eightieth birthday made strikingly manifest the esteem and affection in which Dr. Goessmann is held by the alumni. The beautiful piece of stained glass, symbolizing some of the more prominent features of his life and work, which was then presented to him, though a triumph of affection and the designer's art, all too inadequately serves to express these sentiments.

An attempt to present an estimate of the value of Dr. Goessmann's service to the station and to the State and to set forth his part in the advancement of agricultural science would be out of place in this report; and yet brief mention of some of the more prominent features of his connection with this institution and the great agricultural movements with which his name has been identified seems appropriate. Dr. Goessmann took the chair of chemistry in the Massachusetts Agricultural College within a year of the date when its doors were first opened to students (1867), and this chair he filled, though of late with relatively few classes, until his retirement in June. Coming to this position with the best university training which Europe at that time could afford, he brought to his position the university spirit and method, and almost from the first he made his department in effect an experiment station in agricultural chemistry. Before Massachusetts had a regularly organized experiment station, Dr. Goessmann had carried out a large amount of experimental work, the results of which were published in reports of the college and those of the secretary of the State Board of Agriculture, as well as in numerous agricultural and scientific periodicals. Among the most important of these early investigations are those carried out to determine the possibilities of the beet sugar industry in this country. He was a pioneer in this field, and in his numerous publications clearly outlined the essentials for success. Of more general importance to the country at large was Dr. Goessmann's work in relation to fertilizers. He determined the manurial value of a large number of refuse substances and by-products. To him belongs the honor of having suggested and taken the most important part in the passage of the first law providing for fertilizer control passed in the United States. This law has been worth untold sums to the farmers, in the protection against fraud which it has afforded, while so wisely was it shaped that under Dr. Goessmann's administration it has almost equally served the interests of honest manufacturers and dealers. Among other important investigations conducted by Dr. Goessmann prior to the organization of the experiment station should be mentioned his studies as to the effects of special fertilization upon the composition of fruits, his determination of the effect of girdling upon the quality of grapes, his recognition of the possible relation of fertilizers to certain plant diseases, his work in connection with the reclamation of the Green River salt marsh in Marshfield, his determination of some of the chemical changes taking place in ensilage and his chemical examination of sorghum and its products. He was associated with Stockbridge in his investigations which led up to the theory of special fertilization which bears the name of the latter, and in the study of the results of fertilizer applications through observations upon a lysimeter and analytical work connected therewith.

Upon the organization of an experiment station in Massachusetts, in 1882, Dr. Goessmann was made director. This position Dr. Goessmann held until 1895, when the Massachusetts or State station was combined with the station established as a department of the college under the Hatch act. At this time Dr. Goessmann was made honorary director, and was placed in charge of the chemical fertilizer and fertilizer control work, in which position he continued to serve the station with distinguished ability until his retirement the 1st of July last. He has taken with him in his retirement the good will, affection and esteem of all who have been associated with him, and all share in the hope that he will have many years yet of health, usefulness and happiness.

A number of minor changes in the station staff have been made during the year. These changes in many cases have been made necessary by the resignation of men who have left us for positions of greater responsibility and reward. The changes in staff have been as follows: —

E. THORNDIKE LADD, M.S., promoted to the position of first assistant chemist, fertilizer division, in place of EDWARD G. PROULX, B.Sc., resigned.

WALTER E. DICKINSON, B.Sc., in place of E. THORNDIKE LADD, promoted.

Carl S. Pomeroy, B.Sc., Ph.B., assistant horticulturist, in place of Charles P. Halligan, B.Sc., resigned.

George H. Chapman, B.Sc., assistant botanist, in place of Neil F. Monahan, B.Sc., resigned.

Upon the reorganization of the chemical department, which has been outlined, an additional chemist in the research division was employed. The successful candidate was Robert D. MacLaurin, Ph.D., who comes to us after thorough post-graduate courses in chemistry, and a brief but successful record in research work in the Rockefeller Institute in New York.

During the year Howard A. Parsons, dairy tester in the division of foods and feeding, has resigned, and during the past month we have received the resignations of Walter E. Dickinson and E. Thorndike Ladd, assistant chemists, both of whom resign to accept positions offering superior inducements. The positions thus made vacant have not as yet been filled.

## The Mailing List.

*Revision.* — The revision of the mailing list referred to in the last annual report has been completed. It was found, as anticipated, that many of the addresses carried in the old lists were dead, either because of decease or removal of individuals. The postmasters throughout the State with rare exceptions willingly and heartily lent their aid in revising the lists. As soon as the revision was completed, stencils for use with the Elliott addressing machine were procured. The stencils have been arranged by post offices, which are placed alphabetically in the files, and under each post office the names are alphabetically arranged. As a result of this arrangement, several important advantages are secured: —

1. Publications as addressed can be readily made into bundles for the several post offices. This saves a great amount of time in handling and sorting at the local post office and costs us but very little additional labor.

2. Publications can be much more promptly sent out than was possible previous to this arrangement by post offices.

3. If desired, as for example, in case of an outbreak of injurious insects in a certain locality, bulletins or ciculars can be readily sent to that locality.

The addresses of parties outside of Massachusetts are arranged alphabetically under the several states and countries.

*Mailing List.* — On completion of the revision, it was found that the number of live addresses was as follows: —

| | |
|---|---|
| Residents of Massachusetts, | 14,612 |
| Residents of other States, | 1,720 |
| Residents of foreign countries, | 169 |
| | 16,501 |

In addition, the station uses the Washington mailing list, which includes the addresses of those engaged in agricultural college and experiment station work. The total number of addresses in this list is about 2,000.

The station also uses the following special lists for meteorological reports, libraries, newspapers and exchanges: —

| | |
|---|---|
| Meteorological, | 260 |
| Libraries, | 158 |
| Newspapers and exchanges, | 520 |

During the past year an effort has been made to secure the addresses of all prominent cranberry growers. These addresses have for the most part been secured by writing to chairmen of the boards of selectmen in towns in the cranberry district, and to these men, most of whom prepared the lists promptly and without charge, the thanks of the station are due. The number of addresses in this list is 1,505.

During the past year we have added substantially 1,000 addresses to our general mailing list. These additions have been made in response to direct requests, and without solicitation on our part.

### PUBLICATIONS.

Our rapidly growing mailing list has already greatly increased the costs of publication, and these costs must inevitably continue to increase with the constant additions to our lists. The time is not far distant when additional money for publications will be required. During the past year the publications of the station have been as follows: —

*Publications during 1907.*

Annual report: —

Contains reports of the director, treasurer and heads of departments, with papers on a large number of miscellaneous subjects. 207 pages.

Bulletins: —

No. 112. The Examination of Cattle and Poultry Foods, J. B. Lindsey. 60 pages.
No. 113. Analysis of Manurial Substances and Fertilizers and Trade Values, C. A. Goessmann. 30 pages.
No. 114. The Oriental Moth: a Recent Importation, H. T. Fernald. 15 pages.
No. 115. Preliminary Report on Cranberry Insects, H. J. Franklin. 15 pages.
No. 116. The San José Scale, H. T. Fernald. 22 pages.
No. 117. Trade Values and Fertilizer and Soil Analyses, C. A. Goessmann and H. D. Haskins. 22 pages.
No. 118. Molasses and Molasses Feeds for Farm Stock, J. B. Lindsey, E. B. Holland and P. H. Smith. 32 pages.
Technical, No. 3. Blossom End Rot of Tomatoes, Elizabeth H. Smith. 19 pages.
Complete Index to Bulletins and Reports of the Hatch Experiment Station, from 1888 to 1907. 48 pages.

Circulars: —

No. 1. Cotton-seed Meal, J. B. Lindsey and P. H. Smith. 8 pages.
No. 2. Cut Worms, H. T. Fernald. 2 pages.
No. 3. The Apple Maggot or Railroad Worm, C. E. Hood. 2 pages.
No. 4. Wire Worms, C. E. Hood. 2 pages.
No. 5. Root Maggots, H. T. Fernald. 2 pages.
No. 6. The Lecaniums, or Soft Scales, C. E. Hood. 2 pages.
No. 7. Ants, C. E. Hood. 2 pages.
No. 8. Bulletins of the Agricultural Experiment Stations in Massachusetts. 13 pages.
No. 9. Rules relative to Testing Dairy Cows. 6 pages.
No. 10. Sampling and Sending of Fertilizers, Soils and Feed Stuffs for Free Examination. 3 pages.
No. 11. Chemical Analysis of Soils, Wm. P. Brooks. 2 pages.

The complete index to the publications of the Hatch Experiment Station was very carefully prepared. It includes many cross-references, and will be found exceedingly valuable in connection with complete files of station publications from 1888 to 1907, inclusive. This bulletin will be sent, on application, to parties having files sufficiently complete to make it valuable.

Circular No. 8 gives a complete list of all the bulletins published both by the State and the Hatch Experiment Stations, as well as by the Massachusetts Agricultural Experiment Station, up to the date of its issue in July last. In this list publications which are still available for general distribution are indicated.

The other circulars are for the most part designed for use in answer to correspondence in relation to subjects with which they deal. They cover subjects on which the station receives frequent inquiries, and do so much more fully than would be possible within the limits of a letter.

The annual report of the station is printed by the State, and furnished only in an edition of 6,000. It will not be possible, therefore, to send this report even to all Massachusetts citizens whose names are on our mailing lists. Fifteen thousand copies of this report are, however, furnished to the secretary of the State Board of Agriculture, and are bound with his report, so that it is hoped the report in this form may reach all those who desire it. This plan of publication and distribution must, it seems, mean that many parties in the State receive duplicate copies of our reports. Clearly this is not economy, but we are for the present constrained by a State law to the method of publication outlined. An effort will be made during the coming session of the Legislature to secure a change in the law affecting our publications.[1]

## Bulletins and Reports available for Free Distribution.

The supply of many of our reports and bulletins available for free distribution has been exhausted, but those in the following list will still be furnished on application: —

Bulletins: —

No. 33. Glossary of fodder terms.
No. 34. Fertilizer analyses.
No. 41. On the use of tuberculin (translated from Dr. Bang)
No. 64. Analyses of concentrated feed stuffs.
No. 68. Fertilizer analyses.
No. 76. The imported elm-leaf beetle.
No. 81. Fertilizer analyses; treatment of barnyard manure with absorbents; trade values of fertilizing ingredients.

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[1] Since writing the above report the Legislature has authorized the desired change.

No. 83. Fertilizer analyses.
No. 84. Fertilizer analyses.
No. 89. Fertilizer analyses; ash analyses of plants; instructions regarding sampling of materials to be forwarded for analysis.
No. 90. Fertilizer analyses.
No. 92. Fertilizer analyses.
No. 97. A farm wood lot.
No. 98. Inspection of concentrates
No. 99. Dried molasses beet pulp; the nutrition of horses.
No. 100. Fertilizer analyses; market values of fertilizing ingredients.
No. 102. Analyses of manurial substances and fertilizers; market values of fertilizing ingredients.
No. 103. Analyses of manurial substances; instructions regarding sampling of materials to be forwarded for analysis; instructions to manufacturers, importers, agents and sellers of commercial fertilizers; discussion of trade values of fertilizing ingredients.
No. 105. Tomatoes under glass; methods of pruning tomatoes.
No. 107. Analyses of manurial substances forwarded for examination; market values of fertilizing ingredients; analyses of licensed fertilizers collected in the general markets.
No. 109. Analyses of manurial substances forwarded for examination; analyses of Paris green and other insecticides found in the general markets; instructions regarding the sampling of materials to be forwarded for analysis; instructions to manufacturers, importers, agents and sellers of commercial fertilizers; discussion of trade values of fertilizing ingredients for 1906.
No. 113. Fertilizer analyses.
No. 114. The oriental moth; a recent importation.
No. 115. Preliminary report on cranberry insects.
No. 116. The San José scale.
No. 117. Trade values and fertilizer and soil analyses.
Technical Bulletin No. 2. The graft union.
Technical Bulletin No. 3. The blossom end rot of tomatoes.
Special Bulletin. The coccid genera *Chionaspis* and *Hemichionaspis*.
Index to bulletins and annual reports of the Hatch Experiment Station published previous to June, 1895.
Index to bulletins and reports, 1888–1907.
Annual reports for 1898–1907.

Of many of the other bulletins of the station, a few copies still remain. These will be supplied only to complete sets for libraries. Circular No. 8, which gives a complete list of bulletins published by this station, will be sent on application.

The co-operation and assistance of farmers, fruit growers and horticulturists, and all interested directly or indirectly in agriculture, are earnestly requested. Communications should be addressed to Massachusetts Agricultural Experiment Station, Amherst, Mass.

### ASPARAGUS SUBSTATION, CONCORD.

The work with asparagus in Concord, which is located on land leased from Mr. Charles W. Prescott, follows two distinct lines: (1) in co-operation with the Bureau of Plant Industry, of the United States Department of Agriculture, an effort to breed rust-resistant types of asparagus; (2) fertilizer experiments under the Adams fund in the effort to throw light upon the general question of the specific plant food requirements of this crop.

*Breeding Experiments.* — The Bureau of Plant Industry, through its agents in various parts of the world, has brought together a very large collection of varieties of asparagus. These have been drawn from all countries where the crop is grown. In most cases seed was procured. This seed was sown in a hothouse in Washington early last spring, and the young plants were sent in flats to Concord. This method of starting the plants was adopted in the belief that considerable time might thereby be saved. The number of varieties started was 36, but seed of several varieties was obtained from a number of sources, and 54 lots of seedlings were handled in this manner. The degree of success attending this method was only moderately satisfactory. The results varied widely with varieties, but in most cases there was a considerable percentage of loss, — greater no doubt than it otherwise would have been, on account of the extremely dry season. The young plants which survived made a fairly good growth. In addition to these varieties, our breeding plots now contain 35 other varieties, which have been brought together from various sources many of them having been collected by the Bureau of Plant Industry. Among the different varieties thus brought together in the same field may already be noted a very considerable variation in the apparent susceptibility to rust, and it may confidently be hoped that the objects in view in the experiment will ultimately, in large measure, at least, be attained.

*Fertilizer Experiments.* — The land selected for the fertilizer experiments lies in the Bedford Street district in the town of Concord. For a number of years previous to 1906 the field had been lying fallow, and was grown up with briers, small birches, weeds, etc. In preparation for the fertilizer experiments the field was cleared of brush and trees and plowed in the spring of 1906. It then received an application of fertilizers at the following rates per acre: —

| | |
|---|---|
| Lime (tons), | ½ |
| Basic slag meal (tons), | ½ |
| High grade tankage (pounds), | 600 |
| Muriate of potash (pounds), | 300 |
| Nitrate of soda (pounds), | 100 |

These with the exception of the lime, were mixed, evenly spread and harrowed in. The lime was applied by itself. In order to subdue the witch grass and other weeds, the field was harrowed a number of times during the late spring, and on May 15 it was sown to buckwheat. The buckwheat made a heavy growth, and was plowed under when fully grown. The field was then harrowed and sown to winter rye. This was plowed under in the early spring of 1907, and the asparagus set. The field is laid out in forty twentieth-acre plots, separated by dividing strips 5 feet and 1½ inches in width.

The dimensions of the plots are 129 feet by 16 feet 10½ inches. Each plot contains five rows. Each dividing strip contains one row set in the middle. The distance between plants in the rows is 2 feet 6 inches. The plants were raised by Mr. Frank Wheeler of Concord, and were from seed of the Giant Argenteuil variety, specially selected by Mr. Wheeler on account of apparent vigor and capacity to resist rust. These plants were exceptionally large and strong, and one year old at the time of setting. Practically every plant started, and the growth throughout the season was remarkably strong. Many of the plants attained a height in excess of 6 feet. All the details of the work were superintended or carried out by Mr. Charles W. Prescott, to whose skill and faithful attention, in connection with the thorough preparation which the land had received, the fine growth of the plants must be largely attributed. Numerous interesting variations in growth on the different plots were noted during the season, but it is yet too early to present the details of treatment, or to discuss the effects of the different fertilizer applications.

### Cranberry Substations.

The station is carrying on work with cranberries along two distinct lines and in two different localities: (1) the study of cranberry insects in Wareham; (2) fertilizer experiments with cranberries in Falmouth.

*Work on Cranberry Insects.* — The station was fortunately able to command once more the services of Mr. H. J. Franklin for the study of problems connected with cranberry insects. Mr. Franklin spent the entire season, from the middle of April to the middle of October, in the cranberry district, most of the time in the town of Wareham. As the result of the season's work, our knowledge of cranberry insects has been greatly extended at numerous points, and the tentative conclusions reached as a result of the first season's work have been in many cases confirmed. A bulletin presenting the results of the first season's work, and containing advice as to the treatment to be adopted for the prevention of injury from the more important cranberry insects, has been issued during the year. This has been sent to all cranberry growers whose addresses we were able to obtain, — about 1,500. It has been found that the injury due to many insects can be for the most part prevented by a thorough destruction of vegetation around the shores of the bog, and suitable control of the water in flooding. Methods of spraying have been found to be fairly effective in some cases. The bulletin on cranberry insects, which gives all details, can still be furnished on application.

*Fertilizer Experiments.* — The fertilizer experiments in Falmouth are located in what is known as the Red Brook bog, belonging to Mr. N. H. Emmons of Boston and Falmouth. The present is the second season that these experiments have continued, and results which are believed to be of considerable significance have been obtained. The possibility of making exact comparisons between different fertilizer treatments has been in considerable measure reduced, owing to the unfortunate breakage during last winter of one of the dikes, thus exposing a portion of the plots used in fertilizer experiments throughout the winter, while another portion of the plots was under water. It is not best, therefore, to undertake a discussion of the results in detail at this time. The following conclusions, however, appear to be warranted: —

1. The use of nitrate of soda greatly stimulates the growth of vines, and on bogs where vine growth is naturally free, this fertilizer should be used sparingly if at all. It has been noted, however, that the size of the berries is considerably increased wherever nitrate has been applied.

2. The application of acid phosphate appears to favor early maturity of the fruit, accompanied apparently by decrease in size. It would be premature to assert that this fertilizer element should not be used at all, but the indication is that the quantity needed is relatively small.

3. Among the fertilizer elements applied, the potash appears to have exerted the most favorable influence on the yield of fruit. Not only has it apparently increased the quantity, but it seems highly favorable to the development of a bright color, which gives the fruit an unusually attractive appearance. The fruit on the plots to which muriate of potash and acid phosphate were applied was characterized by experts as exceptionally solid and heavy, as well as of fine appearance.

4. The application of lime appears to have been unfavorable to fruitfulness.

## Substation for Orchard Experiments.

Plans have been laid for extensive orchard experiments which will extend over a long period. A six-acre orchard of Baldwin trees set six years ago has been leased for ten years. The location is on the Bay Road in the southern part of the town of Amherst, on the farm of Myron C. Graves. The soil conditions throughout the entire tract appear to be exceptionally even for a tract of such size in this State, and it is believed the orchard affords very exceptional advantages for fertilizer, cover-crop and cultural experiments, which are the principal types of work in view.

## DEPARTMENT REPORTS.

The reports of the heads of the different departments of the station will be found in later pages. The report of the agriculturist is elsewhere briefly summarized.

*Department of Horticulture.* — The report of the department of horticulture includes papers upon three distinct subjects: —

1. Notes on the propagation of apples. The experimental work upon which this paper is based was carried on with dwarf trees. The principal object of the experiment was to determine the influence of the scion on the character of the tree. The variety reported upon in greatest detail was the Baldwin, which was grafted upon three different stocks: the ordinary apple; Doucin; and Paradise. The method of measurement adopted shows a distinct influence apparently due to the variation in scion. The trees on the Doucin stocks were more uniform in shape and taller than those on the Paradise stocks; the trees on Paradise stocks were much stockier than on Doucin; while those on Doucin stocks were in turn much stockier than those on the ordinary stocks.

2. The physiological constant for the germination stage of cress. The methods which have been used in investigations for the determination of physiological constants are briefly outlined. The method reported upon, which is original, is described and compared with the earlier methods. The results with cress are reported in detail.

3. Variation in peas. This paper presents the results obtained by careful observations, and includes tabular records of a large number of observations which are carefully averaged. The results obtained are fruitful in suggestions as to the principles which should be followed in selection in breeding for improvement in any given direction.

*Department of Plant and Animal Chemistry.* — The report of the chemist presents first a numerical statement of the amount of analytical work accomplished during the year. This makes it apparent that the demands upon the station for work of this character are rapidly increasing.

The chemist in charge of the fertilizer control work, H. D. Haskins, reports the analysis of 45 more brands of fertilizers in connection with such work than in 1906. Three hundred and fifty-eight samples in all have been analyzed and nearly 500 collected. Forty-one per cent. of the samples analyzed proved to be below the guaranteed composition in some one or more of the fertilizer elements, but in many cases the deficiency in one element was made up by an excess in one or more of the others. Twenty-one samples of complete fertilizers showed a commercial shortage varying from 79 cents to $13.50 per ton. This section of the report of the chemist presents complete tabular statements, showing the extent to which the fertilizers analyzed equaled or fell short of the guarantees.

The next section of the report presents an account of the execution of the feed law. Samples of feeds analyzed, with the single exception of cotton-seed meal, the quality of which was unusually poor, were found in general to be substantially as guaranteed. The report calls attention to the large amount of analytical work which is done without charge for private individuals in determining the quality of samples of milk and feeds. The results of the execution of the dairy law are briefly presented: 6.62 per cent. of Babcock glassware tested was condemned on account of inaccuracy; of the Babcock machines inspected, 37 in all, 2 were condemned.

The chemist calls attention to the great increase in the amount of work connected with the carrying out of official tests of pure-bred cows. Such tests are now conducted with animals of the Jersey, Guernsey, Holstein-Friesian and Ayrshire breeds. During the past year thirty-five yearly records and seventy records for shorter periods have been completed. Sixty-three cows are now undergoing tests. This work consumes a large amount of time, and, while the station is reimbursed for its money expenditure, it is found to be somewhat of a burden. The work is, however, without doubt important and useful, and until it is provided for in some other way the station will continue to supervise it.

The report of the chemist briefly presents the results of experiments completed with a view to determining the value for different classes of live stock of molasses and molasses feeds. He does not regard molasses as possessing advantages for dairy cows over the more common feeds. For fattening cattle, the use of about 3 pounds daily can be recommended. For horses, a moderate amount of molasses is found to be useful as an appetizer and tonic; and the same is true for pigs. Molasses feeds are in general found to be rather high in price as compared with possible home mixtures, and would seem to possess no advantages as compared with such mixtures.

The results of experiments to determine the effects of soy beans minus the oil and of soy bean oil as food for dairy cows are presented. It was found that the meal, although exceptionally rich in protein, does not change the proportion of the different ingredients of milk. The oil temporarily increases the proportion of fat, and is found to affect the quality of the butter to a considerable extent, and on the whole unfavorably.

The report calls attention to experiments which are in progress on the effects of fat on milk secretion, and refers briefly to research work with soils from the different plots in Field A.[1]

It has been found that feeding molasses in large quantities depresses the digestibility of other foods used with it.

A section of the report of peculiar interest at this time, when the question of milk standards interests so many, deals with the chemical composition of milk. The average composition of the milk of most of the different prominent breeds, based upon a large number of analyses in different sections of the country as well as in foreign countries, is presented.

The effects of fat upon the composition of milk and butter fat and upon the consistency of butter are discussed by Dr. Lindsey. His experiments have shown that neither the proteid nor carbohydrate groups of nutrients when fed in normal amounts have any noticeable effect upon the proportion of different ingredients, nor on the character of butter fat. Any changes which occur as the result of variations in feed are usually consequent upon the kind and quantity of oil contained in the feeds used. Dr. Lindsey has found that when the feeds contain vegetable oils in excess of normal amounts the butter is soft. He finds that the flavor of butter depends primarily on cleanliness, the stage of lactation of the cow, the skill and care of the butter maker and the separator used.

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[1] For an account of the experiments on Field A, see report of the agriculturist, page 32.

The concluding section of the report of the chemical department is a paper by E. B. Holland, on a "Standard for Babcock Glassware." This paper presents a summary of the results of the tests of Babcock glassware carried out at the station since the passage of the dairy law in 1901. A standard for such glassware is proposed and carefully drawn, and rules for testing are presented. The standard and rules proposed by Mr. Holland have not yet been officially sanctioned by the American Association of Agricultural Chemists, but both have met the approval of Dr. Babcock, and they will probably be adopted.

*Department of Botany and Vegetable Pathology.* — The report of Dr. Stone, the head of the department of botany and vegetable pathology, contains papers upon a considerable number of important topics. Of especial interest is Dr. Stone's report concerning methods of separating light and inferior seeds and dirt from commercial or home-grown samples of seeds. The apparatus perfected in the department for this work shows much ingenuity in design, and the work is accomplished with great rapidity and accuracy. The methods used here are especially important for such seeds as tobacco and onions. As a result of the rejection of the inferior seed, a better stand of plants, substantially all of which, coming from sound, heavy seeds, are strong, healthy and disease-resistant, is obtained than is possible when commercial samples are planted. Work of this character is for the present done without charge. There has been a considerable increase in the number of samples sent in to be tested for germination. This work also is done for the present without charge.

The report calls attention to the unusual extent to which sun scald and sun scorch have prevailed among different varieties of trees. These troubles appear to be due primarily in many cases to the loss of a considerable proportion of the fibrous rootlets, which the botanist believes has been due to the excessively cold winters of a few years ago ; and these troubles have shown more largely than usual during the past summer on account of the severe drought which prevailed. The extensive defoliation of many species of trees, notably elms, in the late summer or early fall, is believed to have been the result of the same cause.

The report calls attention to two apparently new diseases: one affecting asparagus, and apparently caused by a species of fusarium; and another affecting the peony, the cause of which has not been determined. No remedy for either of these troubles can at present be suggested.

During the past year the botanist has made careful comparisons between a number of combinations of fungicides and insecticides for potatoes. These experiments were carried out in connection with fertilizer work of the agricultural department which is designed to throw light upon the relative value for different crops of seven different potash salts.[1] There was little or no blight during the season, and all of the combinations tried seemed to possess nearly equal merit as insecticides. From the standpoint, however, of their ability to adhere to the foliage and their qualities in other respects, the botanist ranks the different combinations used in the following order: —

1. Soda bordeaux and Paris green.
2. Bordeaux and sodium benzoate.
3. Bordeaux and disparene (arsenate of lead).
4. Bordeaux and Paris green.
5. Copper phosphate and disparene.

In connection with the variation in fertilizers for the potato crop in this series of experiments,[1] an important influence on the prevalence of scab was noted. The proportion of badly scabbed tubers was much greater where potassium-magnesium carbonate was the source of potash than on any of the other plots.[2] The proportion of scabby tubers was smallest where the muriate and nitrate were the potash salts employed; but the difference between the proportion of scabby tubers on these fertilizers and on the other potash salts was relatively small.

The report of the botanist discusses mosaic diseases of tobacco and the tomato. He finds an important difference between the two diseases in two respects. Healthy tobacco plants set in soil which contains decaying rootlets of diseased plants usually become affected with the disease. In the case of the tomato, a similar result does not follow. The report gives an account of methods tried for the purpose of determining the cause of the mosaic disease in the tomato. The botanist believes his experiments show that the disease is not caused by an excess of any of the fertilizer elements. The mosaic disease of tobacco may be so caused. The disease can be produced in tomatoes by severe pruning, and is at least associated with a deficiency of both the soluble and insoluble forms of catalase in the foliage.

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[1] For a full account of these experiments, see report of the agricultural department, page 39.

[2] The fact that scab is more apt to prove serious in soils which are alkaline has been frequently noticed. The potash-magnesia carbonate is a strongly alkaline fertilizer. Dr. H. J. Wheeler has frequently called attention to this point in reports and bulletins of the Rhode Island Experiment Station and elsewhere.

The report of the botanist includes a suggestive paper on the factors which underlie susceptibility and immunity to disease in plants. This paper emphasizes the necessity of as full and perfect knowledge of the conditions essential for perfect development as possible, and advances the view that when our knowledge is sufficiently complete at this point it will be found possible in large measure to avoid many diseases which at present often prove highly destructive. We find the highest development of cultural methods among American gardeners and hothouse men. In the hothouse, where the climatic conditions are largely under control, there is but little trouble from disease when the conditions are fully understood and the management skillful. In the case of out-of-door crops, control of the climate being impossible, we may not be able so fully to avoid disease ; but even with such crops, the most skillful adaptation of soil, manure and culture to the requirements of the crop will in large measure accomplish the same result.

*Entomological Department.* — The report of this department presents first a summarized statement showing the kind and amount of the work of the year. Brief accounts are also presented of some of the leading lines of experimental work. One of the most important of these is for the determination of the resistance of different crops to fumigation with hydrocyanic acid gas. These experiments are now complete for the cucumber, and similar tests for muskmelons have been begun.

Brief mention is made of experiments for the control of cabbage, turnip and onion maggots, concerning which, owing to causes beyond control, no definite results can yet be presented.

One of the most important lines of experiment during the past year has been the effort to determine the best methods of controlling thrips, which so often cause the blight of the onion. Spraying with kerosene emulsion appears to be the most promising method. The principal difficulty appears to be the production of a machine which will spray a number of rows at once in a sufficiently thorough manner to destroy most of the insects. No perfectly satisfactory machine has yet been invented.

The report makes brief mention of experiments to determine better methods of destroying the San José scale, and the work with cranberry insects at Wareham. Further observations on the oriental moth are presented, and fortunately these indicate that this insect is not likely to become a serious pest. Attention is called to the fact that investigations have been begun to determine the exact geographical distribution of injurious insects. This work would seem to be particularly important, as Massachusetts is close to the northern limit of the distribution of some and near the southern limit of others. The report concludes with a presentation of observations upon the insects of the year.

*Veterinary Department.* — The report of the veterinarian presents an account of two serious outbreaks of disease among poultry. The first of these was European chicken cholera, which was found in two flocks. The identity of the disease was proved by careful microscopic investigations and inoculations. The owners of the affected flocks were promptly informed of the serious character of the disease, and, co-operating heartily with the veterinarian as they did, its prompt suppression was effected, and fortunately the disease did not spread from these flocks, which might easily have been centers of infection.

The other outbreak was found in a flock of chickens raised in brooders upon bare, sandy soil. It produced serious lesions of the feet and legs, and invariably proved fatal. The disease was found not to be infectious in character, and promptly disappeared when the chickens were moved to a more fertile location, where the growth of vegetation afforded some shade. It appears to have been due to the effects of the intense sunshine, aggravated by the character of the soil upon which the chickens were kept. The disease did not affect chickens brooded under hens, although kept on the same kind of soil.

*Meteorological Department.* — The report of the head of this department calls attention to a number of important improvements which have been made in the equipment of the department during the past year. One of the most important of these is the setting up of apparatus over one of the manholes of our heat distribution system for melting snow as it falls. By means of this apparatus it will be possible to secure a more accurate record of the total precipitation, while by means of connections with recording apparatus in the office of the department the time of beginning and ending of storms can be determined with much exactness.

WM. P. BROOKS,
*Director.*

# ANNUAL REPORT

OF GEORGE F. MILLS, *Treasurer* OF THE MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE,

*For the Year ending June 30, 1906.*

*The United States Appropriations, 1906–07.*

| | Hatch Fund. | Adams Fund. |
|---|---|---|
| *Dr.* | | |
| To receipts from the Treasurer of the United States as per appropriations for fiscal year ended June 30, 1907, under acts of Congress approved March 2, 1887 (Hatch fund), and March 16, 1906 (Adams fund), | $15,000 00 | $7,000 00 |
| *Cr.* | | |
| By salaries, | 4,568 74 | 4,731 74 |
| labor, | 4,202 04 | 899 32 |
| publications, | 1,858 60 | – |
| postage and stationery, | 591 39 | – |
| freight and express, | 329 50 | 31 77 |
| heat, light, water and power, | 239 16 | – |
| chemical supplies, | 122 85 | 152 99 |
| seeds, plants and sundry supplies, | 542 31 | 163 02 |
| fertilizers, | 107 85 | 96 48 |
| feeding stuffs, | 495 80 | 176 55 |
| library, | 134 82 | 141 94 |
| tools, implements and machinery, | 259 80 | 8 70 |
| furniture and fixtures, | 371 55 | – |
| scientific apparatus, | 210 04 | 439 92 |
| live stock, | 36 50 | – |
| travelling expenses, | 648 73 | 80 57 |
| contingent expenses, | 28 00 | 2 00 |
| buildings and land, | 252 32 | 75 00 |
| balance, | – | – |
| Total, | $15,000 00 | $7,000 00 |

*State Appropriation, 1906–07.*

| | | |
|---|---|---|
| Cash received from State Treasurer, | $16,500 00 | |
| from fertilizer fees, | 4,745 00 | |
| from farm products, | 1,267 21 | |
| from miscellaneous sources, | 6,800 42 | |
| | | $29,312 63 |

| | | |
|---|---|---|
| Cash paid for salaries, | $12,619 97 | |
| for labor, | 2,925 76 | |
| for publications, | 840 00 | |
| for postage and stationery, | 537 29 | |
| for freight and express, | 174 13 | |
| for heat, light, water and power, | 474 02 | |
| for chemical supplies, | 576 47 | |
| for seeds, plants and sundry supplies, | 338 48 | |
| for fertilizers, | 71 07 | |
| for feeding stuffs, | 454 90 | |
| for library, | 108 61 | |
| for tools, implements and machinery, | 286 84 | |
| for furniture and fixtures, | 848 17 | |
| for scientific apparatus, | 369 78 | |
| for live stock, | 129 05 | |
| for travelling expenses, | 1,479 51 | |
| for contingent expenses, | 57 50 | |
| for buildings and repairs, | 1,122 69 | |
| Balance, | 5,898 39 | |
| | | $29,312 63 |

# DEPARTMENT OF AGRICULTURE.

WM. P. BROOKS, AGRICULTURIST; E. S. FULTON, E. F. GASKILL, ASSISTANTS.

The work in the department of agriculture during the past year has covered the usual field of experiment, and has been devoted chiefly to an effort to throw light upon some of the many problems connected with the use of manures and fertilizers. The number of field plots used in this work has been 318; the number of closed plots, 153; and the number of pots in vegetation experiments, 330. In the majority of our experiments, repetition from year to year, extending over a considerable period, is desirable in order that accidental variations may be as far as possible eliminated, and in order to bring out the variation in results connected with the varying character of our seasons. A detailed account of the results will be presented for only a small proportion of the experiments in progress.

No inconsiderable share of the time of the agriculturist is occupied in answering the many questions which annually come to the station on all matters pertaining to the practice of agriculture. The number of such inquiries answered during the past year has been 824. Experience indicates that inquiries of the same general character are likely to be sent in many times during the year, and we are therefore adopting in this department, in so far as circumstances warrant, the plan of sending circulars, with such comments as the statement of individual conditions seems to require, which has been referred to in the report of the director.

The more important results of the experiments reported in detail may be briefly stated as follows: —

I. — Experiment to determine the relative value as sources of nitrogen of barnyard manure, nitrate of soda, sulfate of ammonia and dried blood. This experiment was begun in 1890. The crop of this year was clover, sown in the standing corn in August of last year. On the basis of total yield (grass as well as clover included), the materials under comparison rank in the following order: nitrate of soda, dried blood, barnyard manure, sulfate of ammonia. The no-nitrogen plots gave a larger total crop than the sulfate of ammonia, and the clover in these plots was better than on any of the others. On the basis of increase in crop as compared with the product of the no-nitrogen plots, taking into account all the crops grown since the experiment began, the materials on a percentage basis rank as follows: nitrate of soda, 100; barnyard manure, 85.92; dried blood, 70.21; sulfate of ammonia, 45.36.

II. — Experiment to determine the relative value of muriate and high grade sulfate of potash. The crops on the basis of which comparison this year is possible were cabbages, rhubarb, raspberries, blackberries, asparagus, corn and squashes. The sulfate of potash gives the larger crops of raspberries and blackberries. For the other crops the muriate gives the larger crops; but the difference is unimportant except in the case of the asparagus, which is much better on the muriate than on the sulfate.

III. — Experiment to determine the relative value of different potash salts for field crops. The salts under comparison were kainit, high-grade sulfate, low-grade sulfate, muriate, nitrate, carbonate and silicate. The crop was potatoes. The salts, on the average of five trials for each, rank in the following order, as measured by the product of merchantable tubers: low-grade sulfate, muriate, nitrate, high-grade sulfate, silicate, carbonate, kainit. There was considerable scab, — a much greater amount on the carbonate than on the other potash salts.

IV. — Experiment to show the relative value for corn of special corn fertilizers, as compared with a mixture richer in potash. The special corn fertilizer gave a larger yield of sound corn. The fertilizer richer in potash excelled in the product of soft corn and stover. With an earlier spring and a hotter season, the proportion of sound corn produced on the fertilizer richer in potash would undoubtedly have been increased.

V. — Experiment to determine the relative value for production of corn of manure alone, as compared with a smaller application of manure and a moderate amount of sulfate of potash. The larger application of manure alone gave a slightly higher yield of sound corn. The combination of manure and potash gave the higher yields of soft corn and stover. There was not much money difference in the value of the crops produced under the two systems, while the cost of the smaller application of manure and potash was at the rate of about $6 per acre less than the cost of the larger application of manure alone.

VI. — Experiment to determine the relative value, as measured by crop production, of a considerable number of phosphates used in quantities to furnish equal phosphoric acid to each plot. The phosphates under comparison were: fine ground, — apatite, South Carolina rock and Tennessee rock phosphates; Florida soft phosphate, basic slag meal, dissolved bone black, raw bone meal, dissolved bone meal, steamed bone meal and acid phosphate. The crop of the past season was mixed hay. The yields on the different phosphates varied relatively little. Even the plots which have received no phosphates during the eleven years the experiment has continued gave a yield at the first crop at the average rate of about 4 tons to the acre, while the highest yield obtained on any of the phosphates at first cutting was only 9,240 pounds.

VII. — Soil tests. The past season was the nineteenth during which the south soil test reported upon has continued. The results show the surpassing importance for the production of satisfactory corn crops of a liberal supply of potash.

VIII. — Experiment in the application of manures and fertilizers for grass. The materials used are: first, barnyard manure; second, wood ashes; and third, a combination of fine-ground bone and potash. The average yield of hay during the past season was at the rate of 5,005 pounds. The average for the fifteen years during which the experiment has been continued has been 6,296 pounds.

IX. — Winter versus spring application of manure on a slope. The crop of the past year was mixed grass and clover. The experiment was a test simply of the residual fertility from previous applications, as no manure was applied this year, as it was feared it would cause serious lodging of the crop. This judgment was justified by the result. The crop was extremely heavy, and considerably lodged in spite of the fact that manure was not applied this year. The differences in yield were small, and did not indicate greater residual fertility where spring application of manure has been the rule than in the other plots.

X. — Experiment in the application of nitrate of soda for rowen. Owing to the deficiency of rainfall in the latter part of July and August, the rowen crop this year was small. The increase in crop resulting from the application of nitrate was not sufficient on the average to repay the cost of application.

XI. — Experiments in feeding hens. These indicate the great value of animal protein and fat and the injurious influence of fibre in the ration.

### I. — MANURES AND FERTILIZERS FURNISHING NITROGEN COMPARED. (FIELD A.)

The materials under comparison in this experiment, all of which are used in such quantities as to furnish equal nitrogen per plot, are barnyard manure, nitrate of soda, sulfate of ammonia and dried blood. The field includes eleven plots, of one-tenth acre each, and, with few and unimportant exceptions, each plot has been manured in the same way since 1890. Each receives equal and liberal amounts of phosphoric acid and potash, the former in the form of dissolved bone black, the latter in the form of muriate, to plots 1, 3, 6, 7, 8 and 9, and in the form of low-grade sulfate to plots 2, 4, 5 and 10. Three plots have had no nitrogen applied to them in any form since 1884. The various materials are used on the other plots in such quantities as to furnish nitrogen at the rate of 45 pounds per acre. Barnyard manure is applied to one plot, nitrate of soda to two, sulfate of ammonia to three and dried blood to two.

From a period very early in the history of this experiment, the plots to which sulfate of ammonia has been applied have shown a tendency to comparative unproductiveness, due apparently to unfavorable chemical or biological conditions. It was thought probable that application of lime would correct these faulty conditions, and 50 pounds of unslaked lime were applied to plot 6 in 1896. The entire field has been twice limed (in 1898 and 1905) since that date, at the rate of about 1 ton to the acre. In spite of these applications, the yield on the sulfate of ammonia plots, as will be noted, is still much below the average of the other plots.

The crops grown in this experiment previous to this year in the order of their succession have been: oats, rye, soy beans, oats, soy beans, oats, soy beans, oats, oats, clover, potatoes, soy beans, potatoes, soy beans, potatoes, oats and peas, and corn.

The crop the past year was alsike clover, considerably mixed, however, with grass, on all plots except those to which no nitrogen has been applied. The clover was sown in the standing corn on Aug. 6, 1906. When the corn was harvested in the fall of 1906, it was very apparent that the clover was relatively weak and unhealthy on all plots to which nitrogen has been applied during the progress of this experiment. The clover was thicker and more healthy on the three no-nitrogen plots than on any of the others. It was poorest on the sulfate of ammonia plots, and especially poor on the plots where sulfate of ammonia has been used in combination with muriate of potash. The relative condition of the clover on the different plots on the opening of spring was about the same as in the autumn, and as on most of the plots it was too thin for a good crop, 3½ pounds of alsike clover seed were sown per plot on April 3. This seed germinated fairly well, but of course the young plants from this seeding affected the rate of yield in the first crop but little. The rates of yield on the several plots and the sources of nitrogen and potash on each are shown in the following table: —

*Yield of Hay and Rowen per Acre (Pounds).*

| Plots. | NITROGEN FERTILIZERS USED. | Hay. | Rowen. |
|---|---|---|---|
| Plot 0, | Barnyard manure, | 3,150 | 600 |
| Plot 1, | Nitrate of soda (muriate of potash), | 4,000 | 450 |
| Plot 2, | Nitrate of soda (sulfate of potash), | 3,900 | 600 |
| Plot 3, | Dried blood (muriate of potash), | 3,050 | 500 |
| Plot 4, | No nitrogen (sulfate of potash), | 3,400 | 650 |
| Plot 5, | Sulfate of ammonia (sulfate of potash), | 2,950 | 300 |
| Plot 6, | Sulfate of ammonia (muriate of potash), | 2,220 | 500 |
| Plot 7, | No nitrogen (muriate of potash), | 3,000 | 850 |
| Plot 8, | Sulfate of ammonia (muriate of potash), | 2,600 | 400 |
| Plot 9, | No nitrogen (muriate of potash), | 2,600 | 650 |
| Plot 10, | Dried blood (sulfate of potash), | 3,850 | 1,190 |

The fact that where the clover was relatively thin grasses came in to a considerable extent serves to obscure the effect of the different materials supplying nitrogen on the clover in the first crop. The second or rowen crop was very small on all plots. The principal reasons for this were two: (1) the first crop was cut late on account of bad weather; (2) there was but little rain during the latter part of the summer. The yield of rowen on the no-nitrogen plots, however, stands relatively much higher as compared with the yield on the other plots than was the case with the first crop. This difference was due to the fact that there was relatively little grass mixed with the clover in the rowen crop.

The average yields of this year on the several fertilizers are shown in the following table: —

| FERTILIZERS USED. | POUNDS PER ACRE. | |
|---|---|---|
| | Hay. | Rowen. |
| Average of no-nitrogen plots (4, 7, 9), | 3,000 | 717 |
| Average of the nitrate of soda plots (1, 2), | 3,950 | 525 |
| Average of the dried blood plots (3, 10), | 3,450 | 845 |
| Average of the sulfate of ammonia plots (5, 6, 8), | 2,590 | 400 |

As a result of all the experiments previous to this year, the materials furnishing nitrogen have produced crops in the following relative amounts: —

| *Relative Crop Averages.* | Per Cent. |
|---|---|
| Nitrate of soda, | 100.00 |
| Barnyard manure, | 96.63 |
| Sulfate of ammonia, | 91.08 |
| Dried blood, | 89.14 |
| No nitrogen, | 70.24 |

Similar averages for this year are as follows: —

| | PER CENT. | | |
|---|---|---|---|
| | Hay. | Rowen. | Hay and Rowen. |
| Nitrate of soda, | 100.00 | 100.00 | 100.00 |
| Barnyard manure, | 79.75 | 114.29 | 83.71 |
| Sulfate of ammonia, | 65.57 | 76.19 | 66.81 |
| Dried blood, | 87.37 | 160.95 | 95.98 |
| No nitrogen, | 76.20 | 136.57 | 83.11 |

Combining the results of this year with those for previous years, on the basis of total yield per plot, the relative standing is: —

| | Per Cent. |
|---|---|
| Nitrate of soda, | 100.00 |
| Barnyard manure, | 95.91 |
| Dried blood, | 91.35 |
| Sulfate of ammonia, | 84.13 |
| No nitrogen, | 70.96 |

Averaging our results on the basis of increase in crop as compared with the no-nitrogen plots, the relative standing for the entire period of the experiment, 1890–1907, inclusive, is as follows: —

*Relative Increases in Yields (Averages for the Eighteen Years).*

| | Per Cent. |
|---|---|
| Nitrate of soda, | 100.00 |
| Barnyard manure, | 85.92 |
| Dried blood, | 70.21 |
| Sulfate of ammonia, | 45.36 |

It will be noticed that, in spite of the fact that the mixture of grass with the clover, as has been pointed out, tends to obscure the effects of the fertilizer treatment on the latter, the combined yield of hay and rowen on the no-nitrogen plots this year is much greater than on the sulfate of ammonia, and practically the same as on barnyard manure. The yield of clover without doubt was actually greater on the no-nitrogen plots than it was on either the dried blood or the nitrate of soda. The fact has been for some time known that clovers, on account of their ability to draw nitrogen from the air under suitable conditions, are able to make relatively vigorous growth on soils to which no nitrogen is applied, provided these receive generous applications of such elements of plant food as lime, phosphoric acid and potash. Just why, however, the clover should do so much better, as was the case, on the no-nitrogen plots than on the other plots in this field is not at present apparent. It must be remembered that these other plots have received equal applications of lime, phosphoric acid and potash. It has been suggested that the failure of the clover to do well on these plots must be due to residual nitrogen, which during the progress of the experiment has gradually accumulated. Calculation, however, shows that the crops harvested from these plots during the years that the experiment has continued must have removed from the soil larger quantities of nitrogen than had been applied.

The fact that the soil has been so heavily limed twice within recent years seems to preclude the conclusion that the relative failure of the clover is due to an acid condition of the soil; and, indeed, careful chemical analyses of samples taken last spring show that the soil of these plots does not, as a rule, contain appreciable quantities of free acid. We are unable, then, at present to account for the results obtained; but careful chemical and biological investigations will be carried out, with a view to throwing light upon this most important question.

### II. — THE RELATIVE VALUE OF MURIATE AND HIGH-GRADE SULFATE OF POTASH. (FIELD B.)

In this experiment, which was begun in 1892, muriate of potash is compared with high-grade sulfate, on a basis of such applications as will furnish equal actual potash per acre in connection with an annual application of fine-ground bone at the rate of 600 pounds per acre. Potash has been applied in different years in varying quantities. At first the applications were exceptionally heavy, — 350 to 400 pounds per acre of these salts were applied. Since 1900 each has been applied at the rate of 250 pounds per acre annually.

The crops during the progress of the experiment have embraced nearly all those common to this latitude. During the past year they have been: cabbages on two plots; asparagus, rhubarb, raspberries and blackberries, all on each of two plots; corn on four; and squashes on two. The rates of yield of the various crops on the different fertilizers are presented in the following table: —

| Crops. | Fertilizers used. | Plot. | Yield per Acre (Pounds). | | |
|---|---|---|---|---|---|
| Cabbages, | Muriate of potash, | 11 | 39,522.70 | | |
| | Sulfate of potash, | 12 | 38,461.50 | | |
| | | | Stalks. | Leaves. | |
| Rhubarb, | Muriate of potash, | 13 | 30,733.90 | 24,526.00 | |
| | Sulfate of potash, | 14 | 30,685.30 | 26,168.20 | |
| Raspberries, | Muriate of potash, | 13 | 42.05 | | |
| | Sulfate of potash, | 14 | 105.14 | | |
| Blackberries, | Muriate of potash, | 13 | 365.38 | | |
| | Sulfate of potash, | 14 | 738.76 | | |
| Asparagus, | Muriate of potash, | 13 | 4,071.10 | | |
| | Sulfate of potash, | 14 | 2,428.00 | | |
| | | | Hard. | Soft. | Stover. |
| Corn, | Muriate of potash, | 15 | 63.56 bush. | 6.05 bush. | 7,943.80 |
| | Sulfate of potash, | 16 | 63.02 bush. | 5.61 bush. | 7,739.00 |
| Corn, | Muriate of potash, | 17 | 64.78 bush. | 5.78 bush. | 8,052.00 |
| | Sulfate of potash, | 18 | 64.94 bush. | 7.10 bush. | 7,781.40 |
| Squashes, | Muriate of potash, | 19 | 10,810.70 | | |
| | Sulfate of potash, | 20 | 8,378.40 | | |

*Cabbages.* — The yield of cabbages on the two potash salts this year is substantially equal. The crop on both was good. This result is not in agreement with results which we have usually obtained. As a rule, the sulfate of potash has given us larger crops of cabbages and better headed than muriate. The crop on this salt this year shows a slight inferiority in total yield. This difference is perhaps accounted for by the fact that the latter part of the summer was exceptionally dry. In seasons with less than normal rainfall and on light soils the muriate of potash often shows itself to be superior to the sulfate for crops which under opposite conditions give the best results with the sulfate.

*Rhubarb.* — With this crop, as with the cabbages, the results are substantially equal, whereas in earlier years the sulfate has given the larger yields. The explanation is perhaps that suggested in discussing the results with cabbages.

*Asparagus.* — It will be noticed that the yield of asparagus on the muriate of potash is much larger than on the sulfate. This is in accordance with the results which have previously been obtained with this crop. The customary practice of depending largely upon muriate as a source of potash would appear, therefore, to be wise.

*Raspberries and Blackberries.* — The yield of both these fruits is exceedingly small, as both were seriously winter-killed. This year, however, as in earlier years, the yield on the sulfate of potash is much greater than on the muriate. This difference in yield is undoubtedly mainly a consequence of the fact that the canes produced where sulfate of potash is applied are better ripened and go through the winter better than where muriate is used.

*Squashes.* — The variety of squashes grown, Delicious, was planted on June 29, having been put in after two failures to get a satisfactory start of carrots on the plots occupied. The date of planting was, of course, far later than is desirable. Autumn frosts, however, held off later than usual, and a moderate crop was secured. The yield on the muriate was considerably greater than on the sulfate.

*Corn.* — Plots 15, 16, 17 and 18 were occupied by a variety test of sixteen different kinds of corn, forwarded for trial by the Bureau of Plant Industry of the Department of Agriculture. The results for the different varieties have not yet been fully worked up, and the total yields only are presented in detail. On one of the pairs of plots the muriate gives a considerably larger crop of grain ; on the other the crops are substantially even. The muriate gives the larger yield of stover in both cases. The latter result is in accordance with those which we have usually obtained where these potash salts have been compared for corn. Earlier experiments have not shown any considerable difference in the value of the two salts for grain production, and the results of this year, not being in agreement on the two pairs of plots, cannot be regarded as especially significant. They were possibly somewhat affected by the fact that so large a number of varieties was included in the experiment ; although an effort to equalize conditions was made by running the rows of the different varieties across the plots, so that each plot included the same quantity of each of the several kinds.

As of possible interest, it may be here stated that among the different kinds grown in this experiment, which included some of those found in the experiments conducted by the department in various parts of the country to be the most promising, flint and dent varieties both being included, the largest yield was furnished by a variety of dent corn known as Minnesota No. 13 and the next largest by the Rustler White dent, a variety largely grown on the college farm in Amherst for the past two years, and obtained originally from a seedsman in Minnesota. Both of these varieties were fairly well ripened, although the cold, rainy spring and early summer months were highly unfavorable to the corn crop in this locality.

## III. — COMPARISON OF DIFFERENT POTASH SALTS FOR FIELD CROPS. (FIELD G.)

The general plan of this experiment is briefly stated in the nineteenth annual report, from which I quote: —

> This experiment is designed to show the ultimate effect upon the soil, as well as the current effect upon the crops, of continuous use of different potash salts. We have under comparison kainit, high-grade sulfate, low-grade sulfate, muriate, nitrate, carbonate and silicate. The field includes forty plots, in five series of eight plots each. Each series includes a no-potash plot, as well as the seven potash salts which have been named. The experiment is therefore carried out each year in quintuplicate. The area of each plot is one-fortieth of an acre. The potash salts under comparison are used in quantities which will supply annually actual potash at the rate of 165 pounds per acre to each of the plots. All plots are equally manured, and liberally, with materials furnishing nitrogen and phosphoric acid.

The experiment began in 1898, and the crops in the several years have been as follows: —

1898. Medium Green soy beans.
1899. Potatoes.
1900. Plots 1–8, cabbage; 9–24, Medium Green soy beans; 25–40, cow peas.
1901. 1–8, wheat; 9–40, corn.
1902. Clover.
1903. Clover.
1904. 1–16, cabbage; 17–40, corn.
1905. Soy beans.
1906. Potatoes.
1907. Potatoes.

As the results of last year indicated an important relation between the supply of potash in available form and the prevalence of blight, it was decided to plant the field to potatoes again in 1907, although it was recognized that this plan involved considerable risk that the crop would be seriously affected by scab, since, in spite of the fact that the seed planted in this field has always been thoroughly treated for destruction of the scab fungus, it had been noticed that the crop in a portion of the plots was somewhat affected by this disease. The amount of scab showing itself this year was unexpectedly serious, and this fact clearly indicates the soundness of the conclusion that potatoes should not as a rule be grown twice in succession upon the same field.

The variety of potatoes grown this year was Green Mountain. The seed was treated with formalin solution in the usual manner. On account of excessive rains throughout the early spring, planting was deferred until later than usual, — May 23. The crop was thoroughly cared for throughout the season, and sprayed twice with different combinations of fungicides and insecticides.[1] The yields per plot and the rates of yield per acre are shown in the following table : —

| Plots. | Potash Salt. | Pounds per Plot. | | | Bushels per Acre. | | |
|---|---|---|---|---|---|---|---|
| | | Large. | Small. | Rotten. | Large. | Small. | Rotten. |
| Plot 1, . | No potash, . . . . | 268.00 | 34.75 | – | 178.67 | 23.17 | – |
| Plot 2, . | Kainit, . . . . . | 354.50 | 31.00 | – | 236.33 | 20.67 | – |
| Plot 3, . | High-grade sulfate, . | 367.00 | 33.50 | – | 244.67 | 22.33 | – |
| Plot 4, . | Low-grade sulfate, . | 369.50 | 23.00 | – | 246.33 | 15.33 | – |
| Plot 5, . | Muriate, . . . . | 353.25 | 47.50 | 1.00 | 235.50 | 31.67 | .67 |
| Plot 6, . | Nitrate, . . . . . | 372.00 | 19.00 | .75 | 248.00 | 12.67 | .50 |
| Plot 7, . | Carbonate, . . . . | 328.25 | 39.25 | – | 218.83 | 26.17 | – |
| Plot 8, . | Silicate, . . . . . | 345.50 | 36.00 | 9.00 | 230.33 | 24.00 | 6.00 |
| Plot 9, . | No potash, . . . . | 333.75 | 36.25 | 13.50 | 222.50 | 24.17 | 9.00 |
| Plot 10, . | Kainit, . . . . . | 396.50 | 19.50 | – | 264.33 | 13.00 | – |
| Plot 11, . | High-grade sulfate, . | 386.50 | 27.50 | .50 | 257.67 | 18.33 | .33 |
| Plot 12, . | Low-grade sulfate, . | 400.00 | 27.75 | .75 | 266.67 | 18.50 | .50 |
| Plot 13, . | Muriate, . . . . | 401.50 | 27.00 | – | 267.67 | 18.00 | – |

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[1] For account of spraying experiments and results, see report of the botanist and vegetable pathologist, page 128.

| Plots. | Potash Salt. | Pounds per Plot. | | | Bushels per Acre. | | |
|---|---|---|---|---|---|---|---|
| | | Large. | Small. | Rotten. | Large. | Small. | Rotten. |
| Plot 14, . | Nitrate, . . . . | 391.00 | 25.25 | – | 260.67 | 16.83 | – |
| Plot 15, . | Carbonate, . . . | 391.25 | 34.00 | – | 260.83 | 22.67 | – |
| Plot 16, . | Silicate, . . . . | 404.00 | 27.50 | 1.00 | 269.33 | 18.33 | .67 |
| Plot 17, . | No potash, . . . | 301.25 | 33.00 | 1.50 | 200.83 | 22.00 | 1.00 |
| Plot 18, . | Kainit, . . . . | 339.50 | 13.00 | .50 | 226.33 | 8.67 | .33 |
| Plot 19, . | High-grade sulfate, . | 328.00 | 17.50 | 45.00 | 218.67 | 11.67 | 30.00 |
| Plot 20, . | Low-grade sulfate, . | 383.50 | 17.25 | 37.00 | 255.67 | 11.50 | 24.67 |
| Plot 21, . | Muriate, . . . | 333.00 | 15.25 | 56.00 | 222.00 | 10.17 | 37.33 |
| Plot 22, . | Nitrate, . . . . | 330.00 | 20.50 | 54.50 | 220.00 | 13.67 | 36.33 |
| Plot 23, . | Carbonate, . . . | 314.00 | 23.50 | 59.00 | 209.33 | 15.67 | 39.33 |
| Plot 24, . | Silicate, . . . . | 330.00 | 16.00 | 72.00 | 220.00 | 10.67 | 48.00 |
| Plot 25, . | No potash, . . . | 166.00 | 27.75 | 46.00 | 110.67 | 18.50 | 30.67 |
| Plot 26, . | Kainit, . . . . | 279.00 | 10.25 | 30.00 | 186.00 | 6.83 | 20.00 |
| Plot 27, . | High-grade sulfate, . | 370.50 | 11.50 | 29.00 | 247.00 | 7.67 | 19.33 |
| Plot 28, . | Low-grade sulfate, . | 366.75 | 23.00 | 6.00 | 244.50 | 15.33 | 4.00 |
| Plot 29, . | Muriate, . . . | 359.00 | 23.75 | 4.50 | 239.33 | 15.83 | 3.00 |
| Plot 30, . | Nitrate, . . . . | 336.00 | 24.25 | 2.00 | 224.00 | 16.17 | 1.33 |
| Plot 31, . | Carbonate, . . . | 340.00 | 37.00 | – | 226.67 | 24.67 | – |
| Plot 32, . | Silicate, . . . . | 372.50 | 28.50 | – | 248.33 | 19.00 | – |
| Plot 33, . | No potash, . . . | 198.00 | 25.00 | – | 132.00 | 16.67 | – |
| Plot 34, . | Kainit, . . . . | 284.00 | 14.50 | – | 189.33 | 9.67 | – |
| Plot 35, . | High-grade sulfate, . | 323.50 | 26.00 | – | 215.67 | 17.33 | – |
| Plot 36, . | Low-grade sulfate, . | 324.50 | 21.25 | – | 216.33 | 14.17 | – |
| Plot 37, . | Muriate, . . . | 297.50 | 33.00 | – | 198.33 | 22.00 | – |
| Plot 38, . | Nitrate, . . . . | 304.00 | 28.50 | – | 202.67 | 19.00 | – |
| Plot 39, . | Carbonate, . . . | 300.00 | 30.25 | – | 200.00 | 20.17 | – |
| Plot 40,[1] . | Silicate, . . . . | 226.00 | 33.25 | – | 150.66 | 22.17 | – |

The average yields of sound tubers under the varying fertilizer treatments were as follows: —

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[1] Owing to a shortage in the available supply of silicate of potash, and the impossibility of procuring more, the quantity applied to this plot was only about one-sixth of the regular amount.

*Potatoes.—Average Yields per Acre (Bushels).*

| Potash Salt. | Large. | Small. |
|---|---|---|
| No potash (plots 1, 9, 17, 25, 33), | 168.93 | 20.90 |
| Kainit (plots 2, 10, 18, 26, 34), | 220.47 | 11.77 |
| High-grade sulfate (plots 3, 11, 19, 27, 35), | 234.73 | 15.47 |
| Low-grade sulfate (plots 4, 12, 20, 28, 36), | 245.90 | 14.97 |
| Muriate of potash (plots 5, 13, 21, 29, 37), | 236.57 | 19.53 |
| Nitrate (plots 6, 14, 22, 30, 38), | 235.07 | 15.67 |
| Carbonate (plots 7, 15, 23, 31, 39), | 223.13 | 21.87 |
| Silicate (plots 8, 16, 24, 32, 40), | 223.73 | 18.83 |

The no-potash plots this last year gave a yield much inferior to that produced on the plots receiving potash. The highest average yield was produced on the low-grade sulfate of potash: the lowest on the kainit. The differences between the different potash salts, exclusive of the kainit, are, however, relatively small. The full table showing the rates of yield per plot shows that there was considerable rot on about one-half of the plots. Dr. Stone failed to discover *Phytophthera infestans* on the foliage. The rot did not set in until the heavy rains of autumn. The variation in the proportion of decayed tubers in the different plots appears to be due to a difference in moisture conditions. There seems to be no well-defined influence on the proportion of decayed tubers which can be attributed to the potash salt employed. This year, as last, the foliage of the vines on the no-potash plots died much earlier than on any of the plots receiving potash. This premature death of the foliage may, however, have been due simply to lack of vigor consequent upon deficiency of potash in the soil, as Dr. Stone failed to find the characteristic fungi causing either the early or the late blight. It is probable, however, that in seasons with climatic conditions more favorable to the blight fungi they would attack the relatively weak foliage of plants growing where potash is deficient more seriously than they would the more vigorous foliage of better-nourished plants.

## IV. — NORTH CORN ACRE. — SPECIAL FERTILIZER *v.* FERTILIZER RICHER IN POTASH.

This experiment, which was begun in 1891, is designed to test the question whether the special corn fertilizers as offered in our markets are of such composition as seems to be best suited for the production of corn and mixed hay in rotation. The experiment occupies an acre of ground, and is divided into four equal plots, numbered from 1 to 4. Plots 3 and 4 were sown to millet during the first two years of the experiment, but with this exception their treatment has been the same as that of plots 1 and 2, 3 being a duplicate of 1 both as regards fertilizer application and crops produced, and 4 a duplicate of 2. The field has been in mixed grass and clover during three two-year periods, 1897–98, 1901–02 and 1905–06. With these exceptions, and with the further exception referring to millet noted above, corn has been the crop. Whenever the field has been put into grass and clover, it has been seeded in the standing corn of the previous year. Plots 1 and 3 have yearly received an application of fertilizers (a home mixture), furnishing nitrogen, phosphoric acid and potash at the rate per acre which would be supplied by 1,800 pounds of fertilizer having the composition of the average of the special corn fertilizers analyzed at this station. We have made but one change since 1899, as this average changes but little from year to year. The average composition of such fertilizers at that time was as follows: —

| | Per Cent. |
|---|---|
| Nitrogen, | 2.37 |
| Phosphoric acid, | 10.00 |
| Potash, | 4.30 |

The fertilizer used on plots 2 and 4 has been a home mixture richer in potash and much poorer in phosphoric acid than the mixture representing the average corn fertilizers offered in the market. The difference in the application of the fertilizer elements is made clear in the following table: —

*Fertilizer Elements applied annually.*

| Plots. | Rates per Acre (Pounds). | | |
|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ |
| Plots 1 and 3, | 42.6 | 180 | 77.4 |
| Plots 2 and 4, | 47.0 | 50[1] | 125.0 |

The materials applied annually to the several plots are as follows: —

| Fertilizers used. | Plots 1 and 3 (Pounds Each). | Plots 2 and 4[2] (Pounds Each). |
|---|---|---|
| Nitrate of soda, | 30.0 | 50.0 |
| Dried blood, | 30.0 | – |
| Dry ground fish, | 37.5 | 50.0 |
| Acid phosphate, | 273.0 | 50.0[1] |
| Muriate of potash, | 37.5 | 62.5 |

This field was limed in 1900 at the rate of 1 ton to the acre, and again this year at the same rate.

For the past two years the land has been in mixed grass and clover. The sod was plowed in May, and the corn, Rustler White dent, was planted on May 25. The rates of yield on the several plots and the averages for the two systems of manuring are shown in the following tables: —

*Yields per Acre.*

| Plots. | Sound Corn (Bushels). | Soft Corn (Bushels). | Stover (Pounds). |
|---|---|---|---|
| Plot 1 (lesser potash), | 59.75 | 4.24 | 6,400 |
| Plot 2 (richer in potash), | 56.00 | 7.10 | 7,060 |
| Plot 3 (lesser potash), | 57.75 | 5.75 | 6,760 |
| Plot 4 (richer in potash), | 52.00 | 8.25 | 6,720 |

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[1] By mistake plots 2 and 4 received the same application of acid phosphate in 1906 as plots 1 and 3.

[2] Plot 4 this year received in addition 100 pounds of basic slag meal.

*Average Yields per Acre.*

| PLOTS. | Sound Corn (Bushels). | Soft Corn (Bushels). | Stover (Pounds). |
|---|---|---|---|
| Plots 1 and 3 (lesser potash), | 58.75 | 5.00 | 6,580 |
| Plots 2 and 4 (richer in potash), | 54.00 | 7.68 | 6,890 |

It will be noticed that the combination of fertilizers representing the special corn fertilizer gives an average yield of sound corn at the rate of about 4¾ bushels per acre more than plots 2 and 4. The yield of soft corn and of stover is, however, larger on plots 2 and 4. We have here an illustration of the well-known effect of a liberal supply of soluble phosphoric acid in hastening maturity, — an effect which was especially important during the past season, on account of the cold and rainy spring and the low average summer temperature. The greater weight of stover (field cured) on plots 2 and 4 may be in part a consequence of the fact that the crop was not so fully matured, although it has been repeatedly noted in our experiments that a liberal supply of potash promotes a heavy yield of forage. The addition of the basic slag meal to plot 4 has produced no apparent benefit during the past season.

### V. — SOUTH CORN ACRE. — MANURE ALONE *v.* MANURE AND POTASH.

The objects in view in this experiment and the general plan are stated in the following quotation from my last annual report: —

> The object in view in this experiment is to compare the crop-producing capacity of manure alone applied in fairly liberal amounts with a combination of a lesser amount of manure and a moderate quantity of a potash salt. An acre of land is used in the experiment. It is divided into four plots, of one-quarter acre each. Two of the plots (1 and 3) have received applications of manure only; the other two plots (2 and 4) have been fertilized by applications of lesser amounts of manure, together with a potash salt.
>
> This experiment was begun in 1891. The crop for the first six years was corn. Corn was raised also in 1899 and 1900, and in 1903 and 1904. The field has been put into mixed grass and clover three times, being seeded in the summer preceding the first year of cutting in the corn crop.

Each time that the land has been seeded it has been cut twice annually for two years. The sod has then been broken in the fall for the corn crop of the following year. The years when the field has been in mowing are 1898 and 1899, 1901 and 1902, and 1905 and 1906.

Manure has been applied to plots 1 and 3 every year, at the rate of 6 cords per acre, with the following exceptions. No manure was applied in 1897, 1902 and 1905, and in 1898 the amount applied was at the rate of 4 cords per acre. The reason for the omission of manure in the years mentioned and for the smaller amount in 1898 was that experience indicated that its application would cause the grass and clover to lodge badly.

Manure has been applied to plots 2 and 4 as follows: in 1891 and 1892, at the rate of 3 cords per acre; in 1898, at the rate of 2 cords per acre; while in 1897, 1902 and 1905 no manure was applied. In all other years the application has been at the rate of 4 cords per acre. Potash has been applied to plots 2 and 4 at the rate of 160 pounds per acre of high-grade sulfate annually, except in the years when no manure was applied. In these years the potash also was withheld.

The entire field was limed in 1900 at the rate of 1 ton per acre. The manure used has been from well-fed milch cows, and has usually weighed about 3 tons per cord. Both manure and fertilizer were applied broadcast after plowing, and harrowed in.

The following tables show the rates of yield on the several plots and the averages under the two systems of manuring: —

*Yields per Acre, 1907.*

| Plots. | Sound Corn (Bushels). | Soft Corn (Bushels). | Stover (Pounds). |
|---|---|---|---|
| Plot 1 (manure alone), | 65.50 | 6.00 | 7,080 |
| Plot 2 (manure and potash), | 60.40 | 7.78 | 7,508 |
| Plot 3 (manure alone), | 64.25 | 6.00 | 7,380 |
| Plot 4 (manure and potash), | 62.25 | 8.25 | 7,120 |

*Average Yields per Acre.*

| Plots. | Sound Corn (Bushels). | Soft Corn (Bushels). | Stover (Pounds). |
|---|---|---|---|
| Plots 1 and 3 (manure alone), | 64.88 | 6.00 | 7,230 |
| Plots 2 and 4 (manure and potash), | 61.33 | 8.02 | 7,314 |

It will be noticed that the yield of sound corn is somewhat larger on the heavier application of manure alone than on the combination of a lesser quantity of manure and the potash. On the other hand, the average yield of soft corn and of stover is greater on the combination of manure and potash. This result is in some respects analogous to that obtained with fertilizers on the north corn acre. In a more favorable season, the combination of manure and potash is likely to make a better relative showing. In estimating the significance of the results actually obtained, however, it should be kept in mind that, assuming the farmyard manure to cost $5 per cord applied to the field, the annual difference in cost of materials applied under the two systems of manuring has amounted to about $6 per acre, the application of the lesser amount of manure and the potash costing about that amount less than the larger application of manure.

## VI. — COMPARISON OF PHOSPHATES ON THE BASIS OF EQUAL APPLICATION OF PHOSPHORIC ACID.

This experiment, comparing different phosphates, has been in progress eleven years. The phosphates under comparison are as follows: apatite (fine ground[1]), South Carolina rock phosphate (fine ground), Florida soft phosphate, basic slag meal, Tennessee rock phosphate (fine ground), dissolved bone black, raw bone meal, dissolved bone meal, steamed bone meal and acid phosphate. Each is applied in such quantities as to furnish phosphoric acid at the rate of 96 pounds per acre. Three plots have received no phosphoric acid during the entire period of the experiment. All plots have annually received an application of materials furnishing nitrogen and potash and in equal amounts, nitrogen being furnished at the rate of 52 pounds and potash at the rate of 152 pounds per acre. In the case of a few crops requiring especially high manuring (onions and cabbages), a supplementary application of quick-acting nitrogen fertilizers has been made to all plots alike. The crops grown in this field in the order of succession have been as follows: corn, cabbages, corn, — in 1900 two crops, — oats and Hungarian grass (both for hay), onions, onions, cabbages, and mixed grass and clover for two years. The plots were seeded to mixed grass and clover in the spring of 1905; the present is therefore the third year that they have been in grass. The yields and the gain or loss as compared with the no-nitrogen plots are shown in the following table : —

---

[1] Not used either in 1906 or 1907, as it is not offered by dealers.

| Plots. | Fertilizers used. | Yield per Plot (Pounds). | | Yield per Acre (Pounds). | | Gain or Loss (Pounds). | |
|---|---|---|---|---|---|---|---|
| | | Hay. | Rowen. | Hay. | Rowen. | Hay. | Rowen. |
| Plot 1, | No phosphate, . . . . | 1,050 | 50 | 8,400 | 400 | – | – |
| Plot 2, | Apatite, . . . . . . | 1,100 | 63 | 8,800 | 504 | 867 | +71 |
| Plot 3, | South Carolina rock phosphate, | 1,060 | 62 | 8,480 | 496 | 547 | +163 |
| Plot 4, | Florida soft phosphate, . . | 1,060 | 50 | 8,480 | 400 | 547 | +67 |
| Plot 5, | Phosphatic slag, . . . | 1,045 | 52 | 8,360 | 416 | 427 | +83 |
| Plot 6, | Tennessee phosphate, . . | 1,005 | 41 | 8,040 | 328 | 107 | —5 |
| Plot 7, | No phosphate, . . . . | 1,020 | 30 | 8,160 | 240 | – | – |
| Plot 8, | Dissolved bone black, . . | 1,150 | 61 | 9,200 | 488 | 1,267 | 155 |
| Plot 9, | Raw bone, . . . . . . | 1,155 | 63 | 9,240 | 504 | 1,340 | 171 |
| Plot 10, | Dissolved bone meal, . . | 1,145 | 63 | 9,160 | 504 | 1,227 | 171 |
| Plot 11, | Steamed bone meal, . . . | 1,040 | 70 | 8,320 | 560 | 387 | 227 |
| Plot 12, | Acid phosphate, . . . | 1,005 | 75 | 8,040 | 600 | 107 | 267 |
| Plot 13, | No phosphate, . . . . | 905 | 45 | 7,240 | 360 | – | – |

It will be noted that the first crop was exceptionally heavy. The large yield was without doubt due in considerable measure to the weather conditions, which were exceptionally favorable for hay in this locality. Such yields, however, must have been impossible but for the liberal fertilization which the field has received.

It will be noticed that even the no-phosphate plots have given a yield averaging nearly 4 tons per acre at the first cutting. The highest yields were afforded by the dissolved bone black, raw bone and dissolved bone meal, between which there was relatively little difference ; but the fact that the yield on the plot receiving apatite was but little inferior to the yield on these best plots, while with such crops as cabbages in past years it has been hardly one-half as great, taken in connection with the relatively large yield of the no-phosphate plots, sufficiently emphasizes the relative unimportance of supplying phosphoric acid in soluble form for such a crop as mixed grass and clover. The soluble phosphates in this experiment when cabbages were the crop gave yields about two to five times as great as the no-phosphate or the insoluble phosphate plots, while this year the differences are comparatively insignificant. The yield of rowen this year was exceptionally small, and for the same reasons as those which have been mentioned in discussing the results on Field A, viz.: late cutting of the first crop, and protracted drought during the latter part of the summer.

## VII. — Soil Tests.

Soil test work has been continued upon the two acres which have been used so long in work of this description. The plan is the co-operative method adopted in convention in Washington in 1889. The crops of this year have been, on one acre, corn; on the other, mixed grass and clover. The latter was sown this spring, and the crop, which was considerably mixed with weeds, was not weighed separately for the different plots. No detailed report will be made, therefore, for this acre. In this soil test work the kinds of fertilizers and the rates of application per acre are as follows: —

Nitrate of soda, 160 pounds, furnishing nitrogen.
Dissolved bone black, 320 pounds, furnishing phosphoric acid.
Muriate of potash, 160 pounds, furnishing potash.
Land plaster, 800 pounds.
Lime, 800 pounds.
Manure, 5 cords.

*Soil Test with Corn (South Acre).* — This acre has been used in soil tests for nineteen years, beginning in 1889. The field was limed, each time at the rate of 1 ton per acre, in 1899 and 1904. Early in the spring of the present season it received another application of lime, at the rate of 1,000 pounds per acre of R. R. agricultural lime, manufactured by the Rockland-Rockport Lime Company. This was spread after plowing, as in previous years, and harrowed in. The crops for the successive years have been as follows: corn, corn, oats, grass and clover, grass and clover, corn (followed by mustard as a catch crop), rye, soy beans, white mustard, corn, corn, grass and clover, grass and clover, corn, corn, corn, grass and clover, grass and clover. The crop for the present season was corn, which is, therefore, the ninth corn crop grown in the field since the experiment began in 1889. Three times during this period the field has been put into mixed grass and clover, each time for two years. The third grass and clover period ended last year. The sod, however, was not turned until last spring. The soil was well prepared, but, owing to the cold and rainy spring, the crop, Rustler White dent, was not planted until June 1. The character of the past season, as has been pointed out in another section of this report, was rather unfavorable for corn. The following table shows the fertilizers used on the several plots, the rates of yield and the gain or loss per acre compared with the nothing plots: —

*Corn. — South Acre Soil Test, 1907.*

| Plots. | Fertilizers used. | Yield per Acre. | | Gain or Loss per Acre, compared with Nothing Plots. | |
|---|---|---|---|---|---|
| | | Corn (Bushels). | Stover (Pounds). | Corn (Bushels). | Stover (Pounds). |
| Plot 1, . | Nitrate of soda, . . . . . | 1.00 | 720 | —1.00 | —280 |
| Plot 2, . | Dissolved bone black, . . . . | .81 | 700 | —1.19 | —300 |
| Plot 3, . | Nothing, . . . . . . . . | 2.00 | 1,000 | - | - |
| Plot 4, . | Muriate of potash, . . . . . | 23.31 | 6,000 | +21.23 | +4,967 |
| Plot 5, . | Lime, . . . . . . . . | 1.25 | 900 | —.92 | —167 |
| Plot 6, . | Nothing, . . . . . . . . | 2.25 | 1,100 | - | - |
| Plot 7, . | Manure, . . . . . . . . | 72.50 | 6,900 | +70.25 | +5,800 |
| Plot 8, . | Nitrate of soda and dissolved bone black. | 10.06 | 2,500 | +6.25 | +1,400 |
| Plot 9, . | Nothing, . . . . . . . . | 3.81 | 1,100 | - | - |
| Plot 10, . | Nitrate of soda and muriate of potash. | 31.13 | 5,400 | +27.46 | +4,400 |
| Plot 11, . | Dissolved bone black and muriate of potash. | 30.13 | 6,500 | +26.61 | +5,600 |
| Plot 12, . | Nothing, . . . . . . . . | 3.38 | 800 | - | - |
| Plot 13, . | Plaster, . . . . . . . . | 7.75 | 1,200 | +4.37 | +400 |
| Plot 14, . | Nitrate of soda, dissolved bone black and muriate of potash. | 38.31 | 5,500 | +34.93 | +4,700 |

It will be noticed that the yield on the nothing plots is excessively small, amounting on the average to but little more than 2½ bushels of shelled corn per acre and about 1,000 pounds of stover. The use either of nitrate of soda or of dissolved bone black alone gives absolutely no increase; indeed, the crops on these single fertilizer materials were smaller than on the nothing plots. On the other hand, the use of muriate of potash at the rate of 160 pounds per acre (for this, the nineteenth year during which the land has been fertilized only with this material) gives an increase at the rate of rather over 20 bushels of corn and nearly 2½ tons of stover per acre. The tables which follow bring out the effects of the different fertilizer elements when used alone or in different combinations with great clearness: —

| | RESULTS OF THE ADDITION OF NITROGEN TO — | | | | |
|---|---|---|---|---|---|
| | Nothing. | Phosphoric Acid. | Potash. | Phosphoric Acid and Potash. | Average Results. |
| Corn (bushels), | −1.00 | +7.44 | +6.23 | +8.32 | +5.25 |
| Stover (pounds), | −280.00 | +1,700.00 | −567.00 | −900.00 | −11.75 |

| | |
|---|---|
| Value of increase, | $3 89[1] |
| Financial result (loss), | 11 |

| | RESULTS OF THE ADDITION OF PHOSPHORIC ACID TO — | | | | |
|---|---|---|---|---|---|
| | Nothing. | Nitrogen. | Potash. | Nitrogen and Potash. | Average Results. |
| Corn (bushels), | −1.19 | +7.25 | +5.38 | +7.47 | +4.73 |
| Stover (pounds), | −300.00 | +1,680.00 | +633.00 | +300.00 | +578.00 |

| | |
|---|---|
| Value of increase, | $5 89 |
| Financial result (gain), | 3 01 |

| | RESULTS OF THE ADDITION OF POTASH TO — | | | | |
|---|---|---|---|---|---|
| | Nothing. | Nitrogen. | Phosphoric Acid. | Nitrogen and Phosphoric Acid. | Average Results. |
| Corn (bushels), | 21.23 | 28.46 | 27.80 | 28.68 | 26.54 |
| Stover (pounds), | 4,967.00 | 4,680.00 | 5,900.00 | 3,300.00 | 4,712.00 |

| | |
|---|---|
| Value of increase, | $38 75 |
| Financial result (gain), | 35 15 |

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[1] The financial calculations in these tables were based on the following prices: —

| | |
|---|---|
| Nitrate of soda, | $50 00 per ton. |
| Muriate of potash, | 45 00 per ton. |
| Dissolved bone black, | 18 00 per ton. |
| Lime, | 6 00 per ton. |
| Plaster, | 10 00 per ton. |
| Manure, | 5 00 per cord. |
| Corn, | 75 per bush. |
| Stover, | 8 00 per ton. |

| | Results of the Addition to Nothing of — | | | |
|---|---|---|---|---|
| | Lime. | Manure. | Plaster. | Complete Fertilizer. |
| Corn (bushels), . . . | —.92 | +70.25 | +4.37 | 34.93 |
| Stover (pounds), . . . | —167.00 | +5,800.00 | 400.00 | 4,700.00 |
| Value of increment, . . | – | $75 89 | $4 88 | $45 00 |
| Value of decrease, . . . | $1 36 | – | – | – |
| Financial result, . . . | 3 76 (loss). | 50 89 (gain). | 88 (gain). | 34 52 (gain). |

The first of these tables shows that, although nitrate of soda, when used alone, does not increase the crop, it gives a small increase when used in connection with either of the other fertilizer materials alone or with the two together. The nitrate when used in connection with either potash alone or with potash and dissolved bone black has apparently at the same time increased the yield of grain and decreased that of stover. No explanation of this result can be offered. We have, however, figured results on the weights of field-cured stover, and it is possible that variation in moisture content obscures real effects, although this is not believed to be the case, as similar results have been obtained in other years.

The second of these tables shows that, while phosphoric acid used alone gives no increase, it gives a moderate increase both in grain and in stover when used with either of the other fertilizer materials or with both. It will be noticed that on the average the value of the increase in crop due to the use of the phosphate exceeds the cost of that fertilizer.

The third table shows the results obtained by the use of potash. The fact is at once evident that this is the dominant element for the corn crop in this soil. It will be noted that even when used by itself it gives a large increase. It seems surprising that the increase produced when the potash is used in connection with both the other fertilizer elements does not compare more favorably with the increase when it is used alone. We have, it is true, a somewhat larger increase in grain. On the other hand, the increase in stover is not as great as that produced when the potash is used alone. The value of the increase produced by the use of potash greatly exceeds the cost of this fertilizer element.

The last of the four tables under consideration shows the results, as compared with the nothing plots, of the use respectively of the lime, the manure, the plaster and the complete fertilizer. The lime used alone proves absolutely valueless. The manure gives a heavy crop, and its use is highly profitable. Plaster produces a small increase. Complete fertilizer produces a fair crop, and is moderately profitable.

Attention is here called to the fact, previously noted in referring to this field, that the object in view is not to demonstrate the possibility of producing large crops, but to bring out the specific effects of long-continued use of the different fertilizer elements and fertilizer combinations. A more profitable crop could undoubtedly be produced on fertilizers by making a more liberal application. The possibility of doing this is sufficiently demonstrated by the results obtained in raising corn in alternation with mixed mowings on fertilizers alone on the north corn acre,[1] where highly profitable crops have been yearly produced. This soil test work, taken in connection with other experimental work, a part of which is referred to in this report, and in connection with results obtained in various parts of the State, certainly indicates the desirability of a more general and larger use of fertilizers rich in potash in the production of the corn crop.

## VIII. — Experiment in Manuring Grass Land.

The plan of this experiment will be understood from the following outline, quoted from my sixteenth annual report: —

> In this experiment, which has continued since 1893, the purpose is to test a system of using manures in rotation for the production of grass. The area used in the experiment is about 9 acres. It is divided into three approximately equal plots. The plan is to apply to each plot one year barnyard manure, the next year wood ashes, and the third year, fine-ground bone and muriate of potash. As we have three plots, the system of manuring has been so arranged that every year we have a plot illustrating the results of each of the applications under trial. The rates at which the several manures are employed are as follows: barnyard manure, 8 tons; wood ashes, 1 ton; ground bone, 600 pounds; and muriate of potash, 200 pounds, per acre. The manure is always applied in the fall; ashes and the bone and potash in early spring.

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[1] See page 43.

The past season in this part of Massachusetts was in general favorable to a large yield of hay at the first cutting, but the rowen crop was in most fields much smaller than usual, on account of the deficiency of rainfall during the latter part of July and August. It will be noted, however, that the yields in this field during the past season were considerably under the general average for the entire period of the experiment. The results for each of the systems of manuring is shown in the table: —

| FERTILIZERS USED. | YIELD PER ACRE. | | |
|---|---|---|---|
| | Hay (Pounds). | Rowen (Pounds). | Total (Pounds). |
| Barnyard manure, | 3,517 | 1,205 | 4,722 |
| Bone and potash, | 3,903 | 1,728 | 5,631 |
| Wood ashes, | 3,083 | 1,579 | 4,662 |

The average for the entire area this year was 5,005 pounds. The average from 1893 to 1906, inclusive, was 6,389 pounds of well-dried hay per acre annually. The average to date, including the crop of the past season, is 6,296 pounds. A comparison of the average yield throughout the entire period for each of the several systems of manuring will be of interest. These averages are as follows: —

| | Pounds per Acre. |
|---|---|
| When top-dressed with manure, | 6,525 |
| When top-dressed with wood ashes, | 5,965 |
| When top-dressed with bone and muriate, | 6,284 |

In each of plots 1 and 2 two different mixtures of grass seeds are under comparison on equal areas. One of the mixtures in each plot is the usual farmer's mixture of timothy, redtop and clovers. The other mixture contains a considerable variety of seeds, but tall and meadow fescues are the predominating species. These plots were seeded in 1902. During the first few years the timothy mixture gave the larger yields. During the past season the fescue mixture has given the larger total yields on both plots. The differences, however, are not large.

## IX. — EXPERIMENT IN THE APPLICATION OF MANURE.

Full details with reference to the plan followed in this experiment will be found in the nineteenth annual report. Briefly stated, the object is to compare results obtained through spreading manure as it is removed from stables during the winter with the practice of storing in a heap in the open air until spring and then spreading. The field which is used in this experiment slopes quite rapidly toward the west. The experiment was begun in 1899; the past season, therefore, is the ninth during which the experiment has continued. The crop this year was mixed grass and clover, sown in the standing corn of the previous year. No manure was applied either in winter or spring this year, as it was apparent that the land, which has been manured annually at the rate of 6 cords to the acre for the past eight years, would produce as rank a growth as was desirable. The rates of yield per acre and the relative standing of the several plots are shown in the following table: —

*Grass and Clover. — Actual Yields (Pounds per Acre).*

| PLOTS. | NORTH HALF, WINTER APPLICATION. | | SOUTH HALF, SPRING APPLICATION. | |
|---|---|---|---|---|
| | Hay. | Rowen. | Hay. | Rowen. |
| Plot 1, . . . . . . . | 6,885 | 973.3 | 6,903 | 1,081.5 |
| Plot 2, . . . . . . . | 6,885 | 1,261.7 | 6,795 | 1,135.5 |
| Plot 3, . . . . . . . | 5,948 | 1,279.7 | 6,363 | 1,117.5 |
| Plot 4, . . . . . . . | 6,633 | 973.3 | 6,164 | 1,027.4 |
| Plot 5, . . . . . . . | 6,327 | 558.8 | 6,020 | 973.3 |

*Grass and Clover. — Relative Yields (Per Cent.).*

| PLOTS. | NORTH HALF, WINTER APPLICATION. | | SOUTH HALF, SPRING APPLICATION. | |
|---|---|---|---|---|
| | Hay. | Rowen. | Hay. | Rowen. |
| Plot 1, . . . . . . . | 100 | 100 | 100.26 | 111.12[1] |
| Plot 2, . . . . . . . | 100 | 100 | 98.69 | 90.32 |
| Plot 3, . . . . . . . | 100 | 100 | 106.98 | 87.32 |
| Plot 4, . . . . . . . | 100 | 100 | 92.93 | 105.56 |
| Plot 5, . . . . . . . | 100 | 100 | 95.15 | 174.18 |

---

[1] These yields of rowen less accurately measure the fertility than the first crop, for the grass and clover both were unevenly killed in spots by the lodging of the first crop.

The crops of this year are of course a measure only of the residual fertility from previous manuring. The yield was heavy, but, as will be noticed, it was not uniformly favorable to either system of application, although on the whole the plots to which the manure has been applied during the winter gave the heavier yields. These experiments to date do not support the view that the waste following winter application of manure is sufficiently serious to offset the saving in labor, as compared with the system of double handling which storing in heaps to be spread in the spring involves. Our records indicate that spring application costs at the rate of about $4.80 per acre more than the single handling, where the manure is spread when hauled during the winter.

## X. — Nitrate of Soda for Rowen.

This experiment was designed to determine whether the application of nitrate of soda made soon after the first crop is cut will give a profitable increase in rowen. The field, although originally seeded to pure timothy in 1897, now gives crops largely mixed with clover. The total area is a little more than three acres. For the first crop we apply fertilizers at the following rates per acre: nitrate of soda, 150 pounds; muriate of potash, 200 pounds; fine-ground bone, 400 pounds.

For the purpose of the experiment with nitrate of soda, eight equal plots have been laid off, each containing almost exactly one-third of an acre. Alternate plots have annually received a top-dressing of nitrate of soda after the removal of the first crop during the past seven years. For the past four years, in order to facilitate the more even distribution of the nitrate, it has been mixed with sufficient basic slag meal to furnish an application of the latter at the rate of 400 pounds per acre; and to equalize conditions on the alternate plots to which no nitrate is applied, the slag meal is applied to all of these at the same rate. The results obtained the past season are presented in the table: —

*Nitrate of Soda for Rowen.*

| Plots. | Fertilizers used (Rates per Acre). | Yields (Pounds). | Increase per Acre (Pounds). |
|---|---|---|---|
| Plot 1, | Slag meal, 400 pounds, | 1,295 | - |
| Plot 2, | Slag meal, 400 pounds; nitrate of soda, 150 pounds, | 1,584 | 312 |
| Plot 3, | Slag meal, 400 pounds, | 1,249 | - |
| Plot 4, | Slag meal, 400 pounds; nitrate of soda, 150 pounds, | 1,493 | 160 |
| Plot 5, | Slag meal, 400 pounds, | 1,417 | - |
| Plot 6, | Slag meal, 400 pounds; nitrate of soda, 200 pounds, | 1,712 | 417 |
| Plot 7, | Slag meal, 400 pounds, | 1,173 | - |
| Plot 8, | Slag meal, 400 pounds; nitrate of soda, 250 pounds, | 2,285 | 1,112 |

The differences this year, although indicating a beneficial effect in every instance from the application of nitrate, are comparatively small except on plot 8. This is doubtless accounted for in large measure by the extreme drought which prevailed during the latter part of the summer. At current retail prices for nitrate during the past season its application did not prove profitable in any instance.

## XI. — Poultry Experiments.

The poultry work of the past year has consisted in a repetition of the experiments in feeding for eggs which were carried out during the two preceding years. The general results of these experiments cannot perhaps be better expressed than in the following words, quoted from the nineteenth annual report: —

> The experiments had indicated: first, that, provided fat is abundant in the ration, high protein content is not essential; second, that, if the fat content of the ration is low, a large proportion of protein in the feeds used appears to be much more essential; and third, that a large proportion of fiber in the ration used is unfavorable to a good egg product.

The fowls used in the experiments of the past year were, as in previous years, pullets of our own raising. Carefully matched flocks were kept, as in former years, each in a house by itself, all of the houses being precisely similar in general dimensions and construction. The results of the past season's work are confirmatory in every particular of the results previously obtained. A somewhat full account of our experiments will be published in a bulletin which will be issued in the near future. I call attention here, therefore, only to what seem to be some of the more important practical conclusions. In estimating the reliability of these conclusions, it should be remembered that they are based upon results (on the whole in exact agreement throughout) which have been obtained in these long-continued experiments. These practical conclusions are as follows: —

1. When fat is abundant in the rations used in feeding fowls, a satisfactory egg product can be obtained by the use chiefly of grains which are relatively low in protein and high in carbohydrates. This means that corn may safely constitute a large proportion of the grain fed to laying fowls, and that it is not necessary, in order to secure a satisfactory egg product, to pay the higher prices usually demanded for wheat. It seems wiser to depend chiefly upon animal foods, such as beef scraps of good quality, to supply a fairly liberal proportion of protein and to enrich the ration in fat, using corn in connection with the scraps as the chief whole grain. A little wheat may be desirable, for the sake of variety, but to feed wheat as a source of protein seems unnecessary. Vegetable protein is not equal in value for egg production to protein derived from animal substances.

2. If, on the other hand, the combination of feeds used is low in fat, then a ration which furnishes abundant protein will prove considerably superior to one low in protein. If, for example, a dried animal meal from which the fat has been largely extracted, or such material as milk meal (milk albumen) made by the evaporation to dryness of separator skimmed milk low in fat, be used as sources of animal protein, then the combination of foods, including wheat in large quantity and therefore supplying protein in relative abundance, will give more eggs than a combination of foods in which corn, which furnishes less protein, is the principal grain. It has been clearly shown in investigations with domestic animals that in the process of digestion and assimilation the protein of the food may undergo changes resulting in the production of fat. If, as seems probable, the laws controlling metabolism in the digestive and assimilative processes of our domestic fowls are similar to those in the larger domestic animals, we find in this fact an explana-

tion of the difference in relative importance of wheat and corn in the rations of fowls with high and with low fat content. The body temperature of the domestic fowl is much higher than that of the larger domestic animals. To maintain this higher temperature, the oxidation in the body of relatively large quantities of heat producers must be essential. Among food heat-producers fat possesses not only the highest unit value, but is lowest in cost in proportion to value. It seems wise, therefore, in feeding fowls to introduce this nutrient into the ration as largely as is consistent with health. Beef scraps which have been carefully prepared, so that they are free from all bad odors or rancidity, and which contain a fairly large proportion of fat should be freely fed to laying fowls. They may not only with safety, but with positive advantage, be kept before such fowls all the time; and if such scraps are so fed, then corn may safely be the principal grain used.

3. The domestic fowl has little or no ability to digest fiber. Our experiments have shown that a large proportion of fiber in the ration is unfavorable to egg production, other things being equal. The practice, therefore, of using such grains as oats, barley or buckwheat largely in the rations of laying fowls would seem to be unwise. Here again it may possibly in some cases be an advantage to use these grains in small amounts occasionally, for the sake of variety. The writer, however, is not a believer in this practice. He is able to obtain exceedingly satisfactory egg product while depending almost wholly upon corn, cracked or whole, as a grain ration, in connection with a mash including bran or middlings, linseed meal, corn meal and beef scraps.

# REPORT OF THE HORTICULTURAL DIVISION.

F. A. WAUGH, HORTICULTURIST; CARL S. POMEROY, ASSISTANT HORTICULTURIST; E. A. WHITE, FLORIST.

The work in horticulture has followed the same lines as in recent years. Some additional problems have been undertaken, particularly in plant breeding, but there has been no change of general policy.

The experiments in pruning and in grafting have been continued, and have been combined with rather interesting results in the production and management of dwarf fruit trees. This subject just now commands a widespread interest, and the station has been able to be of considerable assistance to suburban residents, fruit growers, nurserymen and other planters of dwarf fruit trees. It has been thought best not to put out a special bulletin on this subject for the present, though a book on dwarf fruit trees, giving the results of our experience, has been published privately.

The station work in horticulture has been greatly strengthened during the year by the addition of some new men to the staff. Mr. C. S. Pomeroy of the University of Vermont has been placed in direct charge of all experimental work, and Prof. E. A. White of Storrs Agricultural College, Connecticut, has taken charge of the work in floriculture.

# NOTES ON THE PROPAGATION OF APPLES.

F. A. WAUGH.

For several years the division of horticulture has been conducting experiments on the propagation of fruit trees, especially apples. For various reasons the so-called dwarfing stocks for apples (Doucin and Paradise) have been largely employed and carefully observed. Two objects have been kept most prominently in mind in these experiments: —

1. To observe as accurately as possible the effects of stock on cion, a field of study which has long been of great interest to horticulturists.

2. To determine the practical merits of different methods of propagation, with especial reference to the production of dwarf fruit trees.

While we have had a considerable quantity of material under study, and have been able to draw fairly satisfactory conclusions of a practical nature, it has been difficult to secure proper quantities of material under suitably uniform conditions for making exact scientific comparisons. The following data, however, seem to be safe and worthy of credit.

## COMPARISON OF STANDARD, DOUCIN AND PARADISE STOCKS.

It should be explained at this point that "standard" apple stocks are the kind almost always employed in this country. They are grown mostly in the west and south, from seeds taken from apple pomace. These seedlings are then sold to nursery men in every part of the country, and are used as stocks for budding or grafting all varieties of apples.

Doucin stocks are mostly imported from France, where they are grown, not from seeds, but from mound layers or cuttings. They are somewhat slower growers than standard stocks, and when budded with common varieties produce trees of a semi-dwarf stature.

Paradise stocks are also grown chiefly in France, and in the same manner as the Doucin stocks. They are still dwarfer in character, and when budded with ordinary varieties produce very small trees. Some of these trees bear fruit abundantly at two or three years old, and appear to be mature at a height of 8 feet, or even less.

This difference in growth may be seen in the nursery to some extent, though usually the dwarfing effect of the Doucin and Paradise stocks is less obvious there than after the trees are planted in the orchard. This reservation is especially necessary in the case of the Baldwin apple, which shows a special aptitude for the Doucin stock. Yet the general influence of the different stocks is seen in a comparison of the growth of two-year-old nursery trees given below: —

*Comparison of Baldwin Trees, Two Years Old.*

| | On Standard. | On Doucin. | On Paradise. |
|---|---|---|---|
| Number of trees, . . . . . . . | 89 | 47 | 37 |
| Average height (centimeters), . . . . | 166 | 116 | 98 |
| Ratio of height to diameter, . . . . . | 103.8 | 82.9 | 70.0 |

The last of these figures, ratio of height to diameter, is the most significant. A small ratio indicates what the nurseryman calls a "stocky" tree. All the figures, however, indicate that considerable differences exist between the three lots of Baldwin trees propagated in the three different kinds of stocks.

However, averages are apt to be misleading, and they never tell the whole story. More information can be conveyed if we adopt the graphic method, as in Figs. 1, 2 and 3, in which each entire group of trees is represented. Here the very different characters of the curves, as well as their differing positions in their enclosing rectangles, indicate the very striking differences in the three lots of nursery trees. The tall, narrow, smooth curve in No. 2 shows that the trees on Doucin stocks were much more uniform than on the other two. As the short, stocky trees are placed at the left of each curve with the tall, slim ones at the right, it is easily seen that the trees on Paradise were much stockier than those on Doucin, and those on Doucin were in turn shorter and stockier than those on ordinary stocks.

### BALDWIN APPLE TREES. — Two years old.

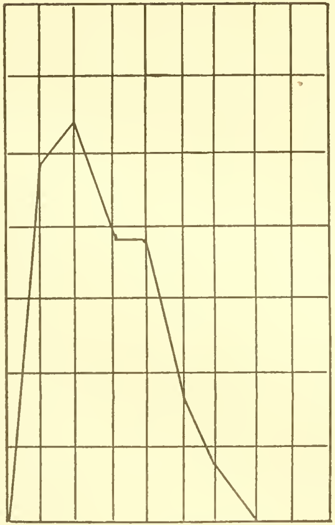

FIG. 1. — On Paradise stocks.

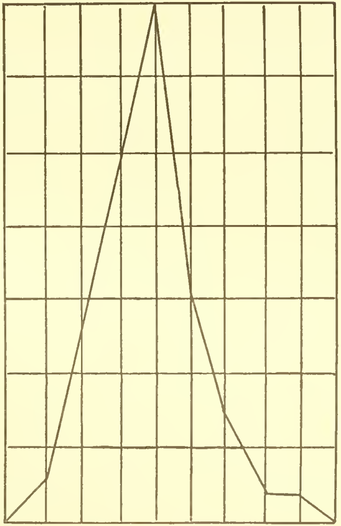

FIG. 2. — On Doucin stocks.

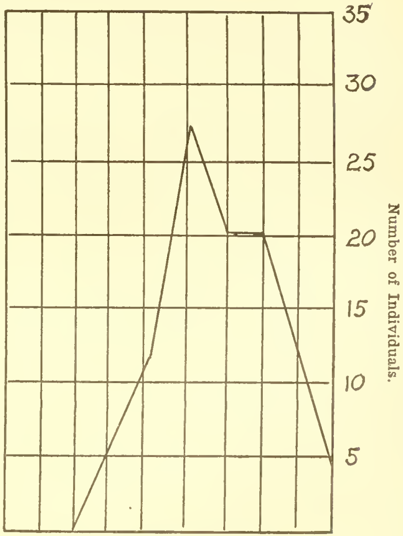

FIG. 3. — On standard stocks.

Diagrams showing the variation in Baldwin apple trees as grown on different stocks. Each curve represents the distribution of 100 trees into classes, according to the ratio of diameter to height. The smaller ratios are at the left, beginning with a ratio of 50 (height ÷ diameter = 50), progressing by 10's and ending with a ratio of 140. Horizontal lines represent numbers of individuals in each class.

These results agree with the common belief regarding the influences of the different stocks; but so far as we know these influences have never before been carefully demonstrated and measured.

The same differences are shown between trees of other varieties, such as Wealthy, McIntosh, Greening, etc., when grown on the different kinds of stocks. Unfortunately, we do not have a series of varieties growing on all three stocks, under uniform conditions and of the same age, so as to make an extended comparison. However, the following averages of two additional lots on Paradise and Doucin stocks will indicate the generally uniform character of the influence of these stocks: —

*Comparison of Two-year-old Nursery Trees.*

| | On Doucin. | On Paradise. |
|---|---|---|
| Wealthy: — | | |
| Number of trees, | 84 | 51 |
| Average height (centimeters), | 165 | 128 |
| Ratio of height to diameter, | 110.0 | 98.5 |
| McIntosh: — | | |
| Number of trees, | 73 | 50 |
| Average height (centimeters), | 148 | 154 |
| Ratio of height to diameter, | 106.4 | 96.2 |

# VARIATION IN PEAS.

F. A. WAUGH; C. S. POMEROY.

Two new ideas, of the magnitude of great discoveries, recently brought to the front in the scientific world have developed an entirely new interest in plant breeding. This new interest has manifested itself both in practical plant-breeding work and in renewed scientific investigation. The two ideas here referred to are: (1) Mendel's law, so called; and (2) the statistical method of studying variation and heredity.

The horticultural division of the Massachusetts Agricultural Experiment Station has been engaged for several years in certain investigations in both these fields. On account of the length of time required to secure definite results, no report has yet been made of these experiments, but a brief report of some of the partial figures may be of interest at this time, particularly by way of illustrating the modern methods of study.[1]

For the purposes of this particular study, one row of peas was staked off in the middle of a field. A careful record was kept of each vine, showing its length, the number of pods borne, the length of the pods and the number of peas in each pod. The variation is shown by the following figures: —

*Variation in Peas.*

| | Minimum. | Maximum. | Average. |
|---|---|---|---|
| Number of vines, | 179 | – | – |
| Length of vines (centimeters), | 20 | 88 | 54.70 |
| Number of pods per vine, | 1 | 13 | 4.68 |
| Length of pods (centimeters), | 2 | 9.5 | 6.88 |
| Number of peas per pod, | – | 9 | 3.46 |

---

[1] The statistical methods of study and graphic methods of presenting data have been developed especially in England by Francis Galton and Prof. Karl Pearson. In this country the same methods have been presented by C. B. Davenport and by E. Davenport, dean of the Illinois College of Agriculture, in his recent book, "Principles of Breeding." It seems better to refer the student of plant breeding to these works, rather than to attempt a more extended explanation of these somewhat complicated methods in this report.

These figures, however, give only very meager information as to the whole range of variation, even in the qualities studied. If we wish to know the facts more accurately, we should refer to the graphic presentation on pages 66, 67 and 68.

Let us study first Fig. 1, showing the variation in length of vine. The spaces along the bottom of the figure represent different lengths of vine, in centimeters. The vertical spaces represent the number of vines of each length, the whole being represented on a percentage basis; *i.e.*, 179 vines as 100. It will be seen that in each 100 vines there were 3 having a length of 20 centimeters, 8 with a length of 30 centimeters (26–35 centimeters), 22 with a length of 40 centimeters, 32 with a length of 60 centimeters, 7 with a length of 70 centimeters and 2 with a length of 80 centimeters. The figure thus shows the composition of the entire row (the "population," as it is technically called) with respect to height.

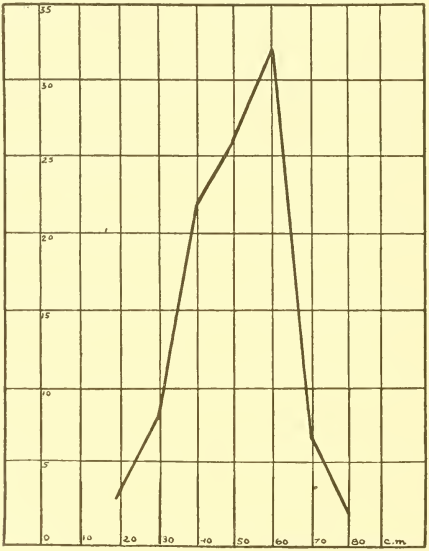

FIG. 1.

One of the most important facts brought out by this graph is that, while the average length of vine is 54.7 centimeters the largest number of vines have a height of 60 centimeters. This shows that the typical Excelsior pea vine in this field was nearly 10 centimeters taller than the average; or, to put the matter another way, a relatively large number of vines run below the typical height.

We may now direct our attention to the number of pods to the vine. These are shown by Fig. 2. From this we see at once that the typical vine in this field (*i.e.*, the kind of vine most frequently found) contains 3 pods, while the average number is 4.68. This average is brought up by a few vines, represented at the right of the curve, bearing an unusually large number of pods.

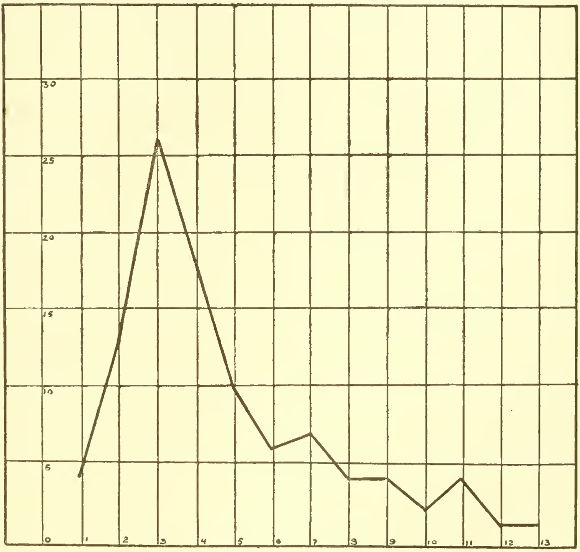

Fig. 2.

At this point it might be suggested that the practical plant breeder, in an endeavor to improve this variety of peas, would naturally select seed from those vines bearing 8, 9, 10 or more pods.

Fig. 3 gives the curve representing the variation in number of peas, to the pod. Two pods in each 100 at the average had no peas, while one in 100 had 8 and one had 9. The average was 3.46, but the typical pod contained 4 peas, — distinctly more than the average.

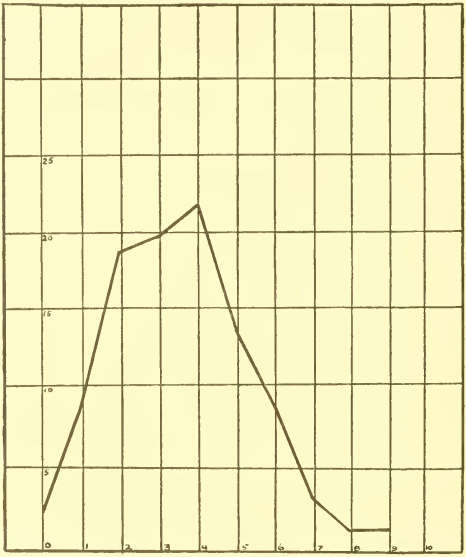

Fig. 3.

Turning once more to the requirements of the practical plant breeder, we see that he would wish to grow the largest number of peas to the pod, as well as the largest number of pods to the vine; and the question arises immediately, whether these two qualities are compatible. Do the vines bearing the largest number of pods bear also the largest number of peas to the pod? or are the pods with the largest number of peas borne on the vines having relatively few pods?

### Studies in Correlation.

These questions bring us immediately to the study of correlation in variation, — one of the most important fields of plant study. In no field, moreover, is the value of the statistical method more conspicuous than in this.

There are two algebraic methods of answering the questions just asked, the first known as Yule's method,[1] and the second may be called Pearson's method [2] or the method of compound series. In applying the former method it is necessary to separate the plants into four groups, according to the two characters to be compared.

If we select those vines which bear 8 pods each or more, putting them in one class, with those bearing 7 pods or less in another class, and if we then subdivide each of these classes according to the average number of peas per pod on each vine, we shall have the following groups and figures: —

| | 8 Pods or More. | 7 Pods or Less. |
|---|---|---|
| 3.6 peas per pod or more, . . . . . . . . . | 9 | 66 |
| 3.5 peas per pod or less, . . . . . . . . . | 19 | 85 |

From which the following computation is made according to Yule's formula: —

$$\frac{(66 \times 19)-(9 \times 85)}{(66 \times 19)+(9 \times 85)}=\frac{489}{2019}=+0.242.$$

Showing a correlation of character in these groups of over 24 per cent.

Now, if the arbitrary division is made between vines bearing 7 pods or over and those bearing 6 pods or less, the rest of the computation following as before, we find the coefficient of correlation reduced to — 0.067; or with the division made between vines bearing 5 pods and those bearing 4, the coefficient of correlation becomes — 0.0126, showing a very little or slightly negative correlation in these groupings.

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[1] See E. Davenport, "Principles of Breeding."

[2] See C. B. Davenport, p. 456, 1907, "Statistical Methods."

In plain language, it appears that the few vines bearing an abnormally large number of pods bear also an abnormally large number of peas to the pod. These would certainly be the vines which the pea grower would select in improving his stock toward greater prolificacy.

If the whole number of vines is studied in one view, without arbitrary division into classes, by the method of compound series, the correlation coefficient is found to be —0.0176,[1] a number so small as to be entirely negligible.

While the results involved are of less practical interest, it may be worth while to give the results of other correlation studies with this same material. For instance, we may study the correlation existing between the length of vine and the number of peas per vine.

Of course we would expect the taller vines to bear the largest number of pods and of peas; and, in fact, the mathematical computation shows a correlation coefficient of +0.668[2] when it is understood that a coefficient of +1.0 shows the highest correlation that can exist, and indicates two characters absolutely dependent on one another, it will be seen that +0.668 indicates very close relationship between length of vine and number of peas borne.

If we compute in a similar manner the relation existing between the number of pods per vine and the total number of peas per vine, we find a correlation coefficient of +0.897.[3]

These peas will be made the basis of further breeding experiments, and a comparison of future generations with the crop of 1907 may be expected to develop new points of interest.

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[1] Standard deviation, pods per vine, 2.64; peas per pod, 1.14.

[2] Standard deviation, length of vine, 10.5; peas per vine, 10.3.

[3] Standard deviation, pods per vine, 2.64; peas per vine, 10.3.

# THE PHYSIOLOGICAL CONSTANT FOR THE GERMINATING STAGE OF CRESS.

F. A. WAUGH; C. S. POMEROY.

The subject of physiological constants was studied several years ago by the senior writer, and a report of certain investigations made, to which the reader is referred for summaries of the theories advanced by various investigators.[1] A brief statement of the present accepted belief is here given, that the subject may be properly understood by all.

A physiological constant may be defined as the amount of heat required to carry a plant through some certain stage of its growth. Thus each species of plant and each phase of development for each species would have its own physiological constant.

De Candolle,[2] writing over fifty years ago, set forth two fundamental principles which are accepted as sound to-day: "1. The active heat is the product of the degree of temperature and its duration. A more intense heat in a short time produces the same effect as a less intense heat in a longer time. This is true, provided the range of temperature and the space of time are limited. 2. Every plant requires a certain minimum of heat for each of its physiological functions, as germinating, leafing, flowering, etc. The temperatures below freezing point have no effect on plants, or at a certain low degree a destroying one; but there are many species on which the lower degrees above the freezing point have no effect. There is a starting point of vegetation for every species at a certain degree of temperature; every species requires a certain sum of heat above a certain degree of temperature, distributed over a certain space of time between a minimum and a maximum of duration." This minimum of temperature, which must be reached before any development takes place, has been called the critical temperature. De Candolle considered 43° as the critical temperature for all plants. Previously it had been placed at the freezing point. Now it is known that this point varies for different species and varieties, and for different functions.

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[1] F. A. Waugh, Vermont Agricultural Station report, II. (1898), pp. 263–272.

[2] Alphonse De Candolle, "Géographie Botanique" (1855).

The theory as above stated assumes as the constant the sum total of temperatures above a certain minimum point for the elapsed time. Such a constant is of use in places having similar climates, but obviously is not suitable for comparisons between places having different lengths of growing seasons; for plants of the same species come to maturity in northern latitudes with a very much less sum of heat than in more southern locations. In order to correct this inaccuracy, Linsser[1] proposed the aliquot idea. To determine the aliquot for any physiological function, the sum temperature for the given phase is divided by the sum temperature for the entire year, as observed at the same station. Thus, instead of depending upon the production of a certain constant *sum* of heat, certain stages are considered as due to be completed when the sum temperatures above the critical temperature equal a definite *fraction* of the sum temperature of the year. Linsser called this fraction the physiological constant.

Another question is presented by this study of the aliquot, namely: Is the critical temperature constant for a given function and species in different latitudes? No investigations are known which have sought to determine this point, but theoretically it must be answered in the negative, as a little thought will show. If we consider this constant to be the same in all latitudes, how can we conceive of certain trees and shrubs having any dormant periods in locations where the temperature rarely falls as low as that at which they bloom in our northern climate? That is, the temperature is continually above the critical temperature, and no chance is offered for the plants to rest.

Heretofore all investigations of this subject have depended upon thermometer readings for their measurements of the sum temperatures. These readings were taken two or three times a day, their mean found, and that figure employed as the temperature of the day. This method has given results which were obviously very inaccurate as to the sum of heat for the time, and much more variable on some days than on others. However, in comparing different sets of observations taken in this same manner, the variations have averaged up with each other fairly well and relatively correct comparisons could be made.

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[1] Carl Linsser, "Die Periodische Erscheinungen des Pflanzenlebens in ihrem Verhaeltniss zu den Waermeerscheinungen." Mem. Acad. Sci., St. Petersb., ser. VII., 11 (1867), No. 7, p. 35.

For several years the division of horticulture has been carrying forward a series of investigations in this field by methods not hitherto applied to this interesting subject. The novelty and value of our methods consist in their being very much more accurate than any previously employed. Instead of depending on public meteorological reports for the computation of accumulated temperatures, we have employed the recording thermograph. This instrument makes a complete and continuous record, showing exactly the quantities of heat to which it has been exposed.

Greater accuracy was secured, secondly, by placing the thermograph in close proximity to the plants under observation. The temperatures recorded are therefore the exact temperatures to which the plants were subjected. When it is understood that previous investigators have been forced in many cases to accept meteorological records taken many miles from the plants under observation, it will be seen that this feature of our work constitutes a considerable improvement.

In the third place, much greater accuracy was secured in methods of computing sum temperatures. Having a perfect record from the thermograph, there remained only the problem of securing an exact measurement of the heat quantities thereon represented. This problem was solved by the use of the planimeter. The thermograph record appears in the form of an irregular line having a generally horizontal direction. If the height of this line, representing degrees of temperature, be measured from some base line (as, *e.g.*, the zero of the thermometer), we may readily construct a figure which offers an exact geometrical representation of the quantity of heat which we seek to measure. Such figures are shown in Fig. 1. Horizontal distances represent degrees of heat; so that the product of length by height, giving the area of the figure, gives also the quantity of accumulated heat.

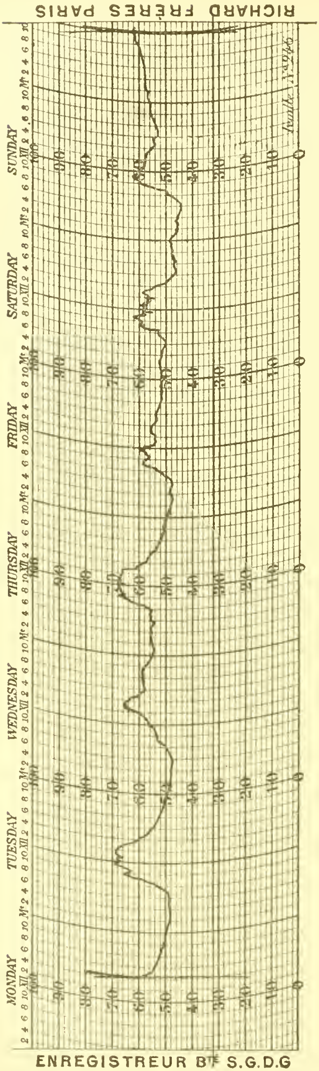
RICHARD FRÈRES PARIS
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY
100
90
80
70
60
50
40
30
20
10
0
ENREGISTREUR BTE S.G.D.G

Fig. 1.

In our work we have used a Coradi rolling sphere planimeter, which is one of the most reliable and accurate styles of planimeter in the market.

In seeking to apply the method here outlined to the actual determination of specific physiological constants, the first requisite was a plant which would pass through its various stages rapidly, so that a number of observations could be made in a comparatively short time; the phase in question must be one easily reproduced, and several individuals of the same age should be under observation at the same time, in order that the length of time required for the completion of the phase may be noted for a greater number. The germination stage of common curled cress was chosen for observation, as it seemed to satisfy the required conditions. Germination is rapid at ordinary temperatures, and is very uniform, and the phase can be studied at all seasons of the year, out of doors or in the greenhouse.

During the past few months 77 thermograph records have been obtained of this phase, and tabulated for study. In these records the sum temperatures above 32° have varied from 2,714 to 4,286, and the time occupied for the completion of the stage from 70 to 210 hours. The problem now, with these figures before us, is to determine at once two unknown quantities: first, the critical temperature; and second, the constant quantity of heat above that temperature required to complete the germination phase in the cress plant.

The method of making this computation will be readily understood from the diagram (Fig. 2). The figure M represents one thermograph record for one experiment, and the figure N another record for another experiment. The lines c f and C F represent the 32° or base line. The irregular lines a d and A D represent the temperature trace. The lines b e and B E represent the critical temperature. Temperatures below

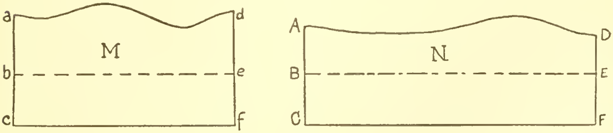

FIG. 2.

b e and B E are assumed to have no effect on the germination of the cress seeds. It is required first to determine the height of b e above c f, which height is assumed to be the same as the height of B E above C F.

According to our assumptions, the area of the figure a b e d is equal to the area of the figure A B E D. If we let the height b c = B C = $x$; and if we let the elapsed time in hours for figure M represented by c f = $y$; and let the elapsed time in hours for figure N be represented by C F = $y'$; then allowing $m$ to represent the total sum temperature for the figure M = (a c f d), and $n$ to represent the total sum temperature above zero recorded in the figure N (A C F D), we may form the following algebraic equation : —

$$m - yx = n - y'x$$

$$(y - y')x = m - n$$

$$x = \frac{m - n}{y - y'}.$$

As the quantities $m$, $n$, $y$ and $y'$ are all directly measurable on any two thermograph records thus compared, $x$ may be easily computed in concrete numbers.

Some difficulty arises in the use of this formula for determining the value of $x$, as when any single thermograph record is compared successively with several others taken at random, decidedly irregular results follow. Values for $x$ can be found varying all the way from —1° to + 60° ; and though the majority of values lie between 5° and 10°, there is still too great variation to make the result satisfactory. This comparatively great variation is due, however, not to any essential inaccuracy in the method, but the smallness of the numbers employed.

In order to get rid of the relatively great variations shown in individual comparisons and to find a reliable average for the whole body of records, these records were plotted as shown in Fig. 3. Here each dot shows the result of a single experiment, referred to a horizontal axis for time and to a vertical axis for accumulated temperature. The distribution of these dots demonstrates at once the practically uniform character of the results.

It is now an easy matter to draw the line A B, forming the axis along which these dots cluster, and which may be assumed to be the theoretical locus of them all.

Having now this average of values shown in the line A B, we may take any time values, as 100 hours and 150 hours, and find immediately the corresponding sum temperatures, — 3,140 and 3,445 degree-hours. Substituting these values in the equation already formed, we find the value of $x$ to be 6.2°. Adding this amount to 32°, the base from which we are computing, we have 38.2°, the critical temperature for the germination phase of cress.

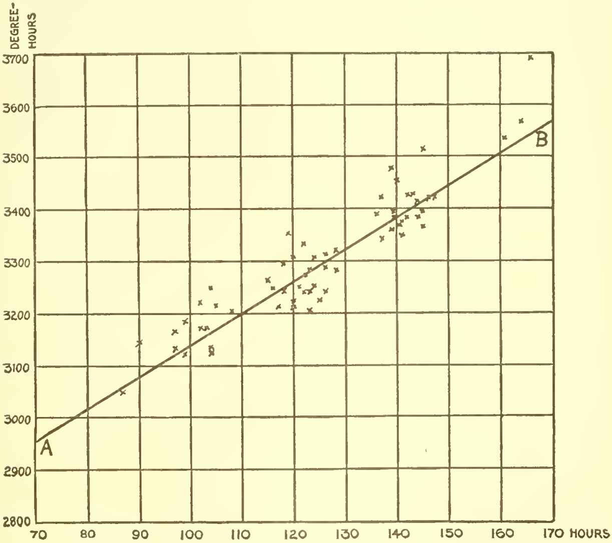

FIG. 3.

The constant sum temperature above 38.2° required for the germination of cress should now be easily found by subtracting from each sum temperature as taken the amount of temperature intervening between 32° and 38.2°. This is secured simply by multiplying the elapsed time by 6.2°.

Applying this method to the records in hand, we find that fairly constant results are secured, according to our expectations. The records at the extreme ends of the scale, especially at the upper end, deviate considerably from the average, but this was to have been expected, and for present purposes these records may fairly be excluded. It seems proper further to throw out three or four other records which on account of excessive deviation are open to suspicion. With these apparently abnormal records temporarily eliminated (they are to be studied further in additional experiments), we secure results which are rather remarkably uniform. Thus, the constant sum temperature being computed to be 2,530 degree-hours, the extreme deviation is less than 100, and the standard deviation is only 36.6°. The probable error is only 24.7°.[1]

Thus, the temperature being known, and lying within reasonable limits, the germination period of cress can be computed in advance within a range of approximately two hours.

The tabulated records used in these computations are appended to this report.

A few abnormal records have been reserved for further study, and there have arisen one or two intricate questions relating to the whole theory of the physiological constant which must be investigated further; but as the figures stand they seem to represent a considerable advance in this interesting field.

*Tabulation of Thermograph Records.*

| Elapsed Time (in Hours) for Germination Phase of Cress. | Accumulated Temperature, in Degree-hours. | |
|---|---|---|
| | Above 32°. | Above 38.2°. |
| 87, . . . . . . . . . . . Ω | 3,054 | 2,516 |
| 90, . . . . . . . . . . . . | 3,148 | 2,590 |
| 97, . . . . . . . . . . . . | 3,135 | 2,533 |
| 97, . . . . . . . . . . . . | 3,164 | 2,562 |
| 98, . . . . . . . . . . . . | 3,126 | 2,518 |
| 99, . . . . . . . . . . . . | 3,186 | 2,572 |
| 100, . . . . . . . . . . . . | 3,127 | 2,507 |
| 102, . . . . . . . . . . . . | 3,221 | 2,589 |
| 103, . . . . . . . . . . . . | 3,173 | 2,535 |

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[1] "Standard deviation" is the geometric mean of deviations. "Probable error" is defined as that departure from the mean, on either side, within which exactly one-half the variates are found.

*Tabulation of Thermograph Records* — Continued.

| ELAPSED TIME (IN HOURS) FOR GERMINATION PHASE OF CRESS. | ACCUMULATED TEMPERATURE, IN DEGREE-HOURS. | |
|---|---|---|
| | Above 32°. | Above 38.2°. |
| 104, | 3,253 | 2,608 |
| 104, | 3,126 | 2,481 |
| 105, | 3,217 | 2,566 |
| 108, | 3,205 | 2,536 |
| 115, | 3,263 | 2,550 |
| 116, | 3,249 | 2,530 |
| 117, | 3,216 | 2,491 |
| 118, | 3,245 | 2,513 |
| 118, | 3,296 | 2,564 |
| 119, | 3,352 | 2,614 |
| 120, | 3,311 | 2,567 |
| 120, | 3,214 | 2,470 |
| 120, | 3,217 | 2,473 |
| 121, | 3,253 | 2,503 |
| 122, | 3,241 | 2,485 |
| 122, | 3,336 | 2,570 |
| 123, | 3,246 | 2,484 |
| 123, | 3,206 | 2,444 |
| 123, | 3,283 | 2,521 |
| 124, | 3,309 | 2,541 |
| 124, | 3,285 | 2,517 |
| 124, | 3,258 | 2,490 |
| 125, | 3,228 | 2,463 |
| 126, | 3,290 | 2,509 |
| 126, | 3,241 | 2,460 |
| 126, | 3,316 | 2,535 |
| 128, | 3,286 | 2,492 |
| 128, | 3,310 | 2,516 |
| 136, | 3,394 | 2,550 |
| 137, | 3,341 | 2,491 |
| 137, | 3,427 | 2,577 |
| 139, | 3,479 | 2,617 |
| 139, | 3,385 | 2,523 |
| 139, | 3,398 | 2,536 |
| 139, | 3,362 | 2,500 |
| 140, | 3,376 | 2,508 |

*Tabulation of Thermograph Records* — Concluded.

| Elapsed Time (in Hours) for Germination Phase of Cress. | Accumulated Temperature, in Degree-hours. | |
|---|---|---|
| | Above 32°. | Above 38.2°. |
| 140 | 3,451 | 2,583 |
| 141 | 3,350 | 2,476 |
| 141 | 3,372 | 2,498 |
| 142 | 3,428 | 2,548 |
| 142 | 3,381 | 2,501 |
| 143 | 3,431 | 2,545 |
| 144 | 3,417 | 2,524 |
| 144 | 3,384 | 2,491 |
| 145 | 3,397 | 2,538 |
| 145 | 3,367 | 2,508 |
| 146 | 3,425 | 2,520 |
| 147 | 3,423 | 2,511 |
| 161 | 3,536 | 2,538 |

| | |
|---|---|
| Constant sum temperature, | 2,530 degree-hours. |
| Standard deviation, | 36.6° |
| Probable error, | 24.7° |

# REPORT OF THE CHEMIST.

## DEPARTMENT OF PLANT AND ANIMAL CHEMISTRY.

JOSEPH B. LINDSEY.

Research division: E. B. Holland and R. D. MacLaurin.
Fertilizer division: H. D. Haskins, E. T. Ladd,[1] W. E. Dickinson.[2]
Feed and dairy division: P. H. Smith and L. S. Walker.
Inspection of fertilizers, feeds and Babcock machines: W. K. Hepburn.
In charge of feeding experiments: R. F. Gaskill.
Clerk and stenographer: Harriet M. Cobb.

Part I. — The Work of the Year briefly outlined.

1. Correspondence.
2. Numerical summary of laboratory work.
3. Execution of the fertilizer law.
4. Miscellaneous fertilizers, soils and by-products for free analysis.
5. Execution of the feed law.
6. Milk, cream and feeds sent for free examination.
7. Execution of the dairy law.
8. Sanitary analysis of drinking water.
9. The testing of pure-bred cows.
10. Special chemical work.
11. Work completed.
12. Work in progress.

Part II. — Dairy and Chemical Studies.

1. The chemical composition of milk.
2. The effect of food on the composition of milk and butter fat, and on the consistency or body of butter.
3. Standard for Babcock glassware.

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[1] Resigned Jan. 1, 1908.

[2] Resigned Dec. 1, 1907.

# Part I. — The Year's Work briefly outlined.

J. B. LINDSEY.

On July 1, the division of foods and feeding and the fertilizer division were united, and termed the department of plant and animal chemistry.

A new division was created, to be known as the research division. This latter division will devote itself to the study of problems in animal nutrition and investigations in plant and animal chemistry.

The fertilizer division takes charge of the annual inspection of commercial fertilizers, examines samples of fertilizers, refuse manurial substances and soils sent to the station, and will devote the remainder of its time to other problems either of a control or research nature.

The feed and dairy division has charge of the execution of the feed and dairy laws, examines samples of water, supervises the testing of pure-bred cows, analyzes samples of feed stuffs and dairy products connected with experiments in progress at the station as well as those sent in for examination.

A brief outline of the work follows, and includes that of the two separate divisions *previous* to the reorganization.

## 1. Correspondence.

The enactment of an amendment to the fertilizer law, requiring the publication of station valuations, the local dealer's retail cash price and the percentage difference between the two, has noticeably increased the correspondence during the past year. In addition to the above, a large number of letters has been received and answered relative to problems connected with fertilizers, feed stuffs and dairying. Numerous analyses of fertilizers, feed stuffs, dairy products and water have been reported directly to the manufacturers, local agents and private persons. The estimated number of letters of all kinds sent out from Dec. 15, 1906, to Dec. 1, 1907, — eleven and one-half months, — approximated 5,395.

### 2. NUMERICAL SUMMARY OF LABORATORY WORK.

From Dec. 15, 1906, to Dec. 1, 1907, there have been received and examined 99 samples of water, 529 of milk, 1,732 of cream, 135 of feed stuffs, 176 of fertilizers and fertilizer materials, 48 soils and 21 miscellaneous. In connection with experiments made by this and other departments of the station, there have been examined 338 samples of milk, 40 samples of cream, 52 samples of butter, 68 samples of butter oil, 111 samples of cattle feeds, 336 samples of agricultural plants, 31 samples of soils and 32 samples of fertilizers. There have also been collected and examined 841 samples of cattle feeds in accordance with the requirements of the feed law, and 513 samples of fertilizer in accordance with the fertilizer law. The total for the year has been 5,102.

In addition to the above, twenty-one candidates have been examined and given certificates to operate Babcock machines, and 3,082 pieces of Babcock glassware have been tested for accuracy of graduation, of which 204, or 6.62 per cent., were inaccurate.

### 3. EXECUTION OF THE FERTILIZER LAW (ACTS OF 1896, CHAPTER 297, AND 1907, CHAPTER 289).

Since July 1, Mr. H. D. Haskins has assumed charge of this work, and has carried it forward with energy and perseverance. Mr. Haskins submits the following report: —

A new fertilizer act, passed by the State Legislature and approved April 11, 1907, reads: —

*Be it enacted, etc., as follows:*

SECTION 1. The bulletins or other publications of the Massachusetts agricultural experiment station containing information about fertilizers shall, in all cases, state the dealers' cash price per ton for such fertilizers, the value per ton of the ingredients of the same, and the percentage of difference between the said price and the said value.

SECTION 2. This act shall take effect upon its passage.

In compliance with the above act, the necessary data have been collected, and fertilizer Bulletin No. 119 gives, in detail, the required information as well as the method employed in obtaining the same.

During the season 513 samples, representing 358 distinct brands, have been analyzed and the results have been published. (See Bulletin No. 119, December, 1907.) Forty-five more licensed brands were analyzed than during the previous year. Seventy-seven manufacturers, importers and dealers have secured licenses for 317 distinct brands of fertilizer during 1907.

Samples were taken in about 80 different towns and cities in the State. Of the 358 brands analyzed, 275 were complete fertilizers; 38 were materials furnishing nitrogen and phosphoric acid, such as ground bone, tankage and dry ground fish; 14 were potash compounds; 9 were phosphoric acid compounds; 15 were compounds furnishing nitrogen; and 7 were compounds furnishing potash and phosphoric acid.

*Trade Values of Fertilizing Ingredients for 1907.*

| | Cents per Pound. |
|---|---|
| Nitrogen: — | |
| In ammonia salts, | 17½ |
| In nitrates, | 18½ |
| Organic in dry and fine-ground fish, meat, blood, and in high-grade mixed fertilizers, | 20½ |
| Organic nitrogen in fine bone and tankage, | 20½ |
| Organic nitrogen in coarse bone and tankage, | 15 |
| Phosphoric acid: — | |
| Soluble in water, | 5 |
| Soluble in ammonium citrate (reverted), | 4½ |
| In fine bone and tankage, | 4 |
| In coarse bone and tankage, | 3 |
| In cotton-seed meal, linseed meal, castor pomace and wood ashes, | 4 |
| Insoluble (in neutral citrate of ammonia in mixed fertilizers), | 2 |
| Potash: — | |
| As sulfate, free from chloride, | 5 |
| As muriate (chloride), | 4¼ |
| As carbonate, | 8 |

The above prices were made up from quotations obtained for the six months preceding March 1, 1907, and actually show the price at which the various ingredients were retailed in markets at centers of distribution in New England, New York and New Jersey.

The average comparative commercial value of the 275 brands of complete fertilizer analyzed was $24.19, the average retail cash price $35.40 and the percentage of difference 44.85.

Of the 275 brands, 113, or about 41 per cent., failed to meet the manufacturers' guaranty in some one or more of the essential elements; many of these deficiencies were made up by an excess of some one or more of the other essential ingredients. Twenty-one of the samples of complete fertilizers, however, showed a commercial shortage ranging from 79 cents to $13.50 per ton.

Eighty-six brands were deficient in one, 23 in two and 4 in all three of the essential elements of plant food. Seventy were deficient in nitrogen, 43 in potash and 28 in phosphoric acid.

Among the 38 brands of ground bone, tankage and dry ground fish, 16 failed to meet the guaranty in nitrogen and 4 in phosphoric acid; only a few of these brands, however, show a commercial shortage. The average retail cash prices, valuations and percentages of difference of the ground bones, dissolved bones, tankages and dry ground fish were as follows: —

| | Retail Cash Price. | Valuation. | Percentage Difference. |
|---|---|---|---|
| Ground bone, . . . . . . . . | $29 46 | $27 45 | 7.32 |
| Dissolved bone, . . . . . . . | 25 50 | 25 03 | 1.88 |
| Tankage, . . . . . . . . . | 21 67 | 29 93 | 27.60[1] |
| Dry ground fish, . . . . . . . | 39 00 | 39 89 | 2.23[1] |

[1] Valuation in excess of selling price.

In case of chemicals and other raw materials, it may be said that 2 samples of nitrate of soda, one sample of dried blood and 5 samples of cotton-seed meal failed to meet the nitrogen guaranty. Two samples of muriate of potash and one sample of carbonate of potash did not meet the potash guaranty. One sample of superphosphate, 1 sample of dissolved bone black and 2 samples of dissolved phosphates and potash fell below the phosphoric acid guaranty.

*Cost of One Pound of Nitrogen, Phosphoric Acid and Potash in Raw Materials.*

| | Cents. |
|---|---|
| Nitrogen: — | |
| From nitrate of soda, | 19¼ |
| From dried blood, | 22½ |
| From cotton-seed meal, | 23⅗ |
| From linseed meal, | 24⅖ |
| From castor pomace, | 23¼ |
| Potash: — | |
| From carbonate of potash, | 8 |
| From sulfate of potash, | 5⅖ |
| From muriate of potash, | 4½ |
| Available phosphoric acid: — | |
| From dissolved bone black, | 7½ |
| From acid phosphate, | 5⅘ |

A pound of total phosphoric acid in "Thomas slag phosphate" has cost the consumer on the average about 5 cents.

### *Summary of Analyses of Complete Fertilizers, 1907.*

The table below shows the comparative quality of the brands of complete fertilizer analyzed during the year, and gives the following information concerning each manufacturer: (*a*) the number of brands of complete fertilizer collected and analyzed; (*b*) the number of brands in which all three of the essential ingredients of plant food are equal to the lowest guaranty; (*c*) the number which do not show a commercial shortage, including those fertilizers where a deficiency of any one element is offset commercially by an excess of some of the other essential ingredients; (*d*) the per cent. of the whole number of complete fertilizers sold by each company not having a commercial shortage. The last three columns indicate the number of brands deficient in one, two and in all three of the essential elements of plant food.

TABLE I.

| MANUFACTURER. | Number of Brands Analyzed. | Number with all Three Elements equal to Lowest Guaranty. | Number equal to Guaranty in Commercial Value. | Per Cent. of Brands not showing a Commercial Shortage. | Number with One Element below Lowest Guaranty. | Number with Two Elements below Lowest Guaranty. | Number with Three Elements below Lowest Guaranty. |
|---|---|---|---|---|---|---|---|
| W. H. Abbott, | 3 | 1 | 3 | 100.00 | 2 | – | – |
| American Agricultural Chemical Company. | 61 | 45 | 58 | 95.08 | 14 | 2 | – |
| Armour Fertilizer Works, | 10 | 8 | 10 | 100.00 | 1 | 1 | – |
| Beach Soap Company, | 3 | 1 | 2 | 66.66 | 2 | – | – |
| Berkshire Fertilizer Company, | 4 | 2 | 4 | 100.00 | 2 | – | – |
| Bonora Chemical Company, | 1 | – | 1 | 100.00 | 1 | – | – |
| Bowker Fertilizer Company, | 33 | 19 | 29 | 90.00 | 8 | 6 | – |
| J. Breck & Son, | 4 | 1 | 1 | 25.00 | 3 | – | – |
| Buffalo Fertilizer Company, | 4 | – | 1 | 25.00 | 3 | 1 | – |
| Coe-Mortimer Company, | 7 | 2 | 3 | 42.85 | 4 | 1 | – |
| Eastern Chemical Company, | 1 | – | 1 | 100.00 | 1 | – | – |
| Eureka Liquid Fertilizer Company, | 1 | – | – | – | – | – | 1 |
| R. & J. Farquhar & Co., | 5 | 4 | 4 | 80.00 | – | 1 | – |
| Fertilizer Products Company, | 1 | 1 | 1 | 100.00 | – | – | – |
| C. W. Hastings, | 1 | – | – | – | 1 | – | – |
| Lister's Agricultural Chemical Works, | 7 | 5 | 6 | 85.71 | 2 | – | – |
| Mapes Formula & Peruvian Guano Company. | 16 | 12 | 16 | 100.00 | 4 | – | – |
| Mitchell Fertilizer Company, | 1 | – | 1 | 100.00 | 1 | – | – |
| National Fertilizer Company, | 15 | 8 | 13 | 86.66 | 5 | 2 | – |
| New England Fertilizer Company, | 7 | 4 | 6 | 85.71 | 2 | 1 | – |
| Olds & Whipple, | 4 | 3 | 4 | 100.00 | 1 | – | – |
| Parmenter & Polsey, | 2 | 2 | 2 | 100.00 | – | – | – |
| R. T. Prentiss, | 3 | – | – | – | – | 1 | 2 |
| Benjamin Randall, | 2 | 1 | 2 | 100.00 | – | 1 | – |
| W. W. Rawson & Co., | 3 | 3 | 3 | 100.00 | – | – | – |
| Rogers & Hubbard, | 8 | 4 | 8 | 100.00 | 4 | – | – |
| Rogers Manufacturing Company, | 8 | 5 | 7 | 87.50 | 3 | – | – |
| Ross Brothers, | 1 | – | 1 | 100.00 | 1 | – | – |
| N. Roy & Son, | 1 | – | – | – | 1 | – | – |
| Russia Cement Company, | 11 | 7 | 11 | 100.00 | 4 | – | – |
| Sanderson Fertilizer Company, | 4 | 1 | 1 | 25.00 | 2 | 1 | – |
| M. L. Shoemaker, | 1 | 1 | 1 | 100.00 | – | – | – |
| Smith Agricultural Chemical Company. | 8 | 1 | 4 | 50.00 | 4 | 2 | 1 |
| Sterling Chemical Company, | 1 | – | 1 | 100.00 | – | 1 | – |

TABLE I — *Concluded.*

| MANUFACTURER. | Number of Brands Analyzed. | Number with all Three Elements equal to Lowest Guaranty. | Number equal to Guaranty in Commercial Value. | Per Cent. of Brands not showing a Commercial Shortage. | Number with One Element below Lowest Guaranty. | Number with Two Elements below Lowest Guaranty. | Number with Three Elements below Lowest Guaranty. |
|---|---|---|---|---|---|---|---|
| Swift's Lowell Fertilizer Company, | 14 | 3 | 12 | 85.71 | 10 | 1 | – |
| Tavender Process Company, | 1 | 1 | 1 | 100.00 | – | – | – |
| Whitman & Pratt, | 4 | 3 | 4 | 100.00 | 1 | – | – |
| Wilcox Fertilizer Works, | 6 | 6 | 6 | 100.00 | – | – | – |
| A. H. Wood & Co., | 1 | 1 | 1 | 100.00 | – | – | – |

## *Summary of Analyses of Ground Bone, Dissolved Bone, Tankage and Dry Ground Fish, 1907.*

The following table presents the same information as the previous one, with the exception of the column giving the percentage number which do not show a commercial shortage; this was omitted on account of the small number of brands of these raw materials licensed by each manufacturer.

TABLE II.

| MANUFACTURER. | Number Brands Analyzed. | Number with Two Elements above Guaranty. | Number equal to Guaranty in Commercial Value. | Number with One Element below Guaranty. | Number with Two Elements below Guaranty. |
|---|---|---|---|---|---|
| W. H. Abbott, | 1 | 1 | 1 | – | – |
| American Agricultural Chemical Company, | 1 | – | – | 1 | – |
| Armour Fertilizer Works, | 1 | 1 | 1 | – | – |
| Beach Soap Company, | 1 | – | 1 | 1 | – |
| Bowker Fertilizer Company, | 4 | 2 | 4 | 2 | – |
| Buffalo Fertilizer Company, | 1 | – | – | – | 1 |
| John C. Dow & Co., | 1 | 1 | 1 | – | – |
| R. & J. Farquhar & Co., | 1 | – | 1 | 1 | – |
| Thomas Hersom & Co., | 2 | 2 | 2 | – | – |
| Home Soap Company, | 1 | 1 | 1 | – | – |
| Geo. E. Marsh Company, | 1 | – | 1 | 1 | – |
| D. M. Moulton, | 1 | – | – | – | 1 |

TABLE II — *Concluded.*

| Manufacturer. | Number Brands Analyzed. | Number with Two Elements above Guaranty. | Number equal to Guaranty in Commercial Value. | Number with One Element below Guaranty. | Number with Two Elements below Guaranty. |
|---|---|---|---|---|---|
| National Fertilizer Company, | 2 | – | 1 | 2 | – |
| Olds & Whipple, | 1 | 1 | 1 | – | – |
| Parmenter & Polsey Fertilizer Company, | 1 | – | 1 | 1 | – |
| W. W. Rawson & Co., | 1 | 1 | 1 | – | – |
| Rogers & Hubbard Company, | 2 | 1 | 2 | 1 | – |
| Rogers Manufacturing Company, | 1 | 1 | 1 | – | – |
| Russia Cement Company, | 1 | 1 | 1 | – | – |
| Sanderson Fertilizer and Chemical Company, | 1 | – | – | 1 | – |
| Springfield Rendering Company, | 2 | 1 | 2 | 1 | – |
| Swift's Lowell Fertilizer Company, | 4 | 2 | 3 | 2 | – |
| T. L. Stetson, | 1 | – | 1 | 1 | – |
| A. L. Warren, | 1 | 1 | 1 | – | – |
| Whitman & Pratt Rendering Company, | 1 | – | 1 | 1 | – |
| Wilcox Fertilizer Works, | 1 | 1 | 1 | – | – |
| Sanford Winter & Son, | 1 | 1 | 1 | – | – |
| J. M. Woodard & Bro., | 1 | 1 | 1 | – | – |

## 4. Miscellaneous Fertilizers, Soils and By-products for Free Analysis.

During the past season 208 samples of fertilizer and refuse by-products used for fertilizing purposes, 79 soils and 25 miscellaneous substances have been fowarded for analysis by farmers and others interested in agriculture. The greater part of these samples have been taken according to printed instructions forwarded from this office. It is the usual custom, when application is made for free analysis, to send the applicant the necessary directions for taking an average sample. This is of the utmost importance, for unless an average sample is furnished, a representative analysis cannot be obtained. As a general thing, these samples are analyzed in the order of their arrival. During the season of the inspection of commercial fertilizers we are not able at all times to promptly attend to the requests for the analysis of this class of materials. Samples are, however, tested as promptly as possible, and reported together with whatever information has been asked for by the applicant. Samples received during the fall and winter months can be examined more quickly, and will ordinarily be reported in a few days after they are received.

## 5. EXECUTION OF THE FEED LAW (ACTS OF 1903, CHAPTER 122).

Since July 1, Mr. P. H. Smith has been charged with carrying out the provisions of this act, and has proved his ability to handle the work to the complete satisfaction of the writer. At the beginning of the year 1907 the inspector made a complete canvass of the State, and collected 477 samples, all of which were examined during the winter and early spring months. It was not possible to publish the results in bulletin form, but the analyses of those falling substantially below the guaranty, or in which any inferior condition was noted, were reported to the manufacturer, with such comments and suggestions as the circumstances seemed to warrant.

The chief result of the inspection was the discovery of numerous lots of inferior cotton-seed meal. Because of heavy rainfalls in the autumn of 1906, large quantities of cotton-seed were considerably damaged, and as a result much of the meal was seriously off grade in color, texture and chemical composition. Of the 75 samples examined, 65 were guarantied to contain 41 or more per cent. protein; and of this number 75 per cent. fell below the guaranty, some very much more so than others. Those samples put out by Kaiser & Brown, Memphis, Tenn., bore a 41 per cent. guaranty and tested 20 to 21.50 per cent. of protein, and were unquestionably fraudulent. Of the 18 lots of Star Brand put out by the J. Lindsey Wells Company, Memphis, Tenn., only 3 met their guaranties; 8 fell nearly 5 per cent. of protein below the minimum, and 7 showed a deficit of 5 to 7 per cent.

While it was naturally beyond the power of man to control the weather conditions, it is believed that many southern brokers were decidedly lax in their method of dealing, and attached a 41 per cent. protein guaranty to whatever meal they shipped, without any particular regard to its quality.

The writer is also convinced that certain northern jobbers soon discovered that the meal they were receiving was inferior to the guarantied representations. They proposed, however, to take their chances, and, in case they were found out, plead ignorance and bad weather; and, if absolutely necessary, settle with the local dealer with the least loss to themselves. The station, by all means in its power, endeavored to keep both the dealer and consumer informed regarding the true conditions. A special circular of 8 pages was prepared and sent to every important feed dealer in the State. All samples of meal received from local dealers and private parties were examined and the results reported within two or three days.

Beginning in late August, 1907, the inspector canvassed the State, and completed his work about the middle of October, collecting 364 samples, all of which have been examined chemically and many also submitted to a microscopic analysis. Concentrated feeds have ruled exceptionally high in price, and many dealers were carrying very limited stocks, some of the ordinary brands being temporarily out of the market. Comparatively few violations of the law were noted, and these were mostly of a technical character. The results of the autumn inspection are now in press (December, 1907), and will appear in bulletin form.

Only one new feed was found during the present autumn. It is known as flax feed, and is composed substantially of one-third small and imperfectly developed flax seed and two-thirds of a variety of ground weed seeds. It has an extremely bitter taste. It has been fed to several cows in the station herd, and no objectionable taint was noted in the milk. The cows ate it rather grudgingly when fed by itself, but consumed it readily when mixed with other grains. The price asked — $26 a ton — is considered high.

### 6. MILK, CREAM AND FEEDS SENT FOR FREE EXAMINATION.

Many dairymen frequently send samples of milk and cream to be tested for total solids and fat, in order to ascertain the quality of the product yielded by the cows composing their herds. The State and local boards of health, as well as the large milk contractors, keep a watchful eye over the composition and condition of the milk supply of the State, and many producers frequently receive warning that their product is deficient in one or more particulars. This induces them to send samples to the station for examination and to ask for advice. The milk is examined promptly, and the results, together with the necessary comments, are forwarded without delay. The station is always ready, to the full extent of its resources, to lend a helping hand to such as ask. One creamery sends all of its samples to the station to be tested for butter fat, and two others send a number of samples every two weeks. A charge is made in such cases, to cover the necessary expense.

Samples of feeds are constantly received from farmers, local dealers and jobbers, who wish to ascertain not only if the materials sent are as represented, but also regarding their particular feeding value. In most cases a partial chemical or microscopic analysis only is necessary to enable one to furnish the desired information. There is a constant tendency on the part of some jobbers to use the station in place of private chemists. It must be distinctly understood that, while it is the aim of the station to furnish all parties with whatever special information its equipment makes possible, its laboratory cannot be continually at the call of those engaged in private business operations.

### 7. EXECUTION OF THE DAIRY LAW (ACTS OF 1901, CHAPTER 202).

This law requires the station (*a*) to test, for accuracy of graduation, all glassware used in connection with the Babcock test or any other test in determining the value of milk and cream; (*b*) to examine for competency all parties operating such tests; and (*c*) to inspect yearly all machines thus used. The station is given authority to collect, from the parties for whom the work is done, sufficient money to cover the actual expense involved.

It is believed that the law could be improved by the addition of an amendment providing a small yearly appropriation ($400), to enable the station to make semiannual inspections of machines and operators, and by giving it authority to remove all operators who employed dirty glassware and who were not conscientiously performing their duties. The result of the year's work may be summarized as follows: —

(*a*) *Testing of Glassware.* — Each piece of glassware found to be correct has the words "Mass. Ex. Sta." etched on. There were examined 3,082 pieces, of which 204, or 6.62 per cent., were condemned.

(*b*) *Examination of Candidates.* — Twenty-one candidates were examined during the year 1907. Most of those presenting themselves for examination had a fair understanding of the process, although it was frequently necessary to refuse certificates, insist on further preparation and a second examination. It is believed that the station would be false to its trust if it allowed candidates to pass who did not have a satisfactory theoretical and practical understanding of the method of procedure.

(*c*) *Inspection of Babcock Machines.* — The annual inspection of Babcock machines was made in November of 1907. Of the 36 places visited, 22 were creameries, 11 milk depots, 2 city milk inspectors and 1 a chemical laboratory. Sixteen of the creameries were co-operative and 5 were proprietary or managed by stock companies. The 11 milk depots in operation were in every case proprietary.

Thirty-seven machines were inspected, of which 2 were condemned and 1 was found needing additional heat. The machines in use are 14 Facile, 9 Agos, 6 Wizard, 5 Electrical and 2 Stoddard.

The glassware as a whole was clean, but a few still use very dirty bottles and 3 were found using untested glassware. Following is a list of creameries and milk depots now in operation that pay by the Babcock test: —

*1. Creameries.*

| LOCATION. | Name. | President or Manager. |
|---|---|---|
| 1. Ashfield, . . . . | Ashfield Co-operative, . . | Wm. Hunter, manager. |
| 2. Belchertown, . . . | Belchertown Co-operative, . | M. G. Ward, president. |
| 3. Brimfield, . . . | F. N. Lawrence, . . . | F. N. Lawrence, proprietor. |
| 4. Cheshire, . . . . | Greylock Co-operative, . | C. J. Fales, president. |
| 5. Cummington, . . . | Cummington Co-operative, . | W. E. Partridge, manager. |

### 1. *Creameries* — Concluded.

| Location. | Name. | President or Manager. |
|---|---|---|
| 6. Egremont, | Co-operative, | E. A. Tyrrell, manager. |
| 7. Easthampton, | Hampton Co-operative, | W. H. Wright, superintendent. |
| 8. Heath, | Cold Spring, | F. E. Stetson, manager. |
| 9. Hinsdale, | Hinsdale Creamery Company. | W. C. Solomon, proprietor. |
| 10. Lenox, | Lenox Creamery, | P. A. Agnew, manager. |
| 11. New Salem, | New Salem Co-operative, | W. A. Moore, president. |
| 12. Monterey, | Berkshire Co-operative, | F. A. Campbell, manager. |
| 13. North Orange, | North Orange Co-operative, | C. E. Dunbar, manager. |
| 14. Northfield, | Northfield Co-operative, | L. R. Smith, superintendent. |
| 15. Shelburne, | Shelburne Co-operative Creamery. | Ira Barnard, manager. |
| 16. Shelburne Falls, | Shelburne Falls Creamery, | T. M. Totman, proprietor. |
| 17. Springfield, | Tait Bros., | Tait Bros., proprietors. |
| 18. Westfield, P. O. Wyben Springs. | Wyben Springs Co-operative, | C. H. Wolcott, manager. |
| 19. West Newbury, | West Newbury Co-operative, | R. S. Brown, manager. |
| 20. Williamsburg, | Williamsburg Creamery, | D. T. Clark, manager. |
| 21. Worthington, P. O. Ringville. | Worthington Co-operative, | M. R. Bates, superintendent. |

### 2. *Milk Depots.*

| Location. | Name. | President or Manager. |
|---|---|---|
| 1. Cambridge, | C. Brigham Company, | J. R. Blair, manager. |
| 2. Cheshire, | Ormsby Farms, | E. B. Penniman, proprietor. |
| 3. Beverly, | Cherry Hill Farm, | Henry Fielden, superintendent. |
| 4. Dorchester, | Elm Farm Milk Company, | J. H. Knapp, manager. |
| 5. Sheffield, | Willow Brook Dairy, | G. W. Patterson, manager. |
| 6. Southboro, | Deerfoot Farm, | S. H. Howes, manager. |
| 7. Boston, P. O. Charlestown. | D. W. Whiting & Sons, | George Whiting, manager. |
| 8. Boston, P. O. Charlestown. | H. P. Hood & Sons, | Wm. Brown, manager. |
| 9. Boston, | Boston Dairy Company, | W. A. Graustein, president. |
| 10. Boston, | Walker-Gordon Laboratory, | Merrill B. Small, manager. |
| 11. Boston, P. O. Roxbury, | Alden Bros., | Alden Bros., proprietors. |

## 8. SANITARY ANALYSIS OF DRINKING WATER.

The experiment station has made sanitary examinations of drinking water since its establishment in 1882. Since January, 1903, because of the abuse of the privilege of free analysis and because of the increase of other important lines of work, a charge of $3 a sample has been made. Special jars are furnished, together with full instructions for collecting and forwarding the samples. An analysis of water sent in shipper's jar will not be made, neither will bacteriological nor mineral analyses be undertaken. A sanitary analysis is made to determine whether the water is contaminated with bad drainage from privy vaults, barns or sinks. A mineral analysis is usually undertaken to ascertain the amount of the several mineral ingredients contained in the water, and thus to gain information relative to its supposed medicinal properties. Parties wishing such information are referred to private chemists.

The water examined the past year was of the usual quality. It was derived largely from springs and wells which had frequently become polluted from the ordinary sources. After the soil once becomes contaminated, it requires considerable time to purify itself, and the water is likely to be rendered unfit for use for a number of years. Too great care cannot be exercised by parties depending for their supply upon wells and springs located close to dwelling houses, barns or other buildings. Samples are sometimes found contaminated with lead. It is strongly advised that all lead pipe be removed and replaced with iron coated with asphaltum or with galvanized-iron pipe. Lead is a poison, and if it once enters the system it is very difficult to eradicate it.

### 9. The Testing of Pure-bred Cows.

This department continues its work in testing pure-bred cows under the rules and regulations of the Jersey, Guernsey, Holstein-Friesian and Ayrshire breeders' associations. The work for Jersey and Guernsey breeders is confined almost exclusively to consecutive monthly tests for the purpose of securing yearly records. Sixty-three cows are now in the test, which requires the services of one man nearly the entire month. Holstein breeders require, as a rule, seven-day tests, although in some cases the time limit is set at fourteen and thirty days, and in occasional instances ninety days, should the animals under test be making phenomenal records. At times between the months of December and May four or five men are thus employed.

Only one Ayrshire breeder (G. E. Stone of Littleton) is at present making a yearly test of his herd.

The station has issued a special circular, giving breeders full information relative to the making of such tests; the circular also states the rules and regulations governing the same. All records, after being verified and sworn to, are forwarded to the several cattle clubs and a duplicate copy kept on file at this office. There have been completed during the year 5 Guernsey and 30 Jersey yearly records and 70 Holstein records (53 of which were of seven days' duration, 10 for fourteen days and 7 in excess of fourteen days).

It hardly seems that it is the proper function of the experiment station to do work of this kind, but it will continue to give such matters attention until other facilities are provided for the accommodation of breeders.

### 10. Special Chemical Work.

The station has co-operated with the association of official agricultural chemists in studying the accuracy of methods for the determination of nitrogen and in ascertaining the most suitable methods to be used in the analysis of condensed milk. These results were reported to several referees of the association.

Mention may also be made of a study to ascertain the best methods to be employed in determining water and the several sugars in molasses, also of a determination of the fat constants of soy bean oil. These investigations will be published as a part of this report or elsewhere.

### 11. Work Completed.

#### *Molasses and Molasses Feeds.*

The station has made a study of the value of molasses and molasses feeds for dairy cattle, horses and swine, and has published its findings, together with the most important results secured by German and French investigators, in Bulletin No. 118, which is now ready for distribution.

*The value of molasses* was discussed under the following headings: composition, effect of molasses on digestibility of other feed stuffs, digestion coefficients for molasses, relative values of molasses and corn meal, and the uses of molasses as a component of the daily rations for the several important kinds of farm animals. The conclusions may be summarized briefly as follows: —

*For Dairy Cattle.* — No particular advantage is to be gained under ordinary conditions by the northern farmers, from the use of molasses as a food in place of corn meal and similar carbohydrates. As an appetizer for cows out of condition, to induce a temporary maximum food consumption and for facilitating the disposal of unpalatable and inferior roughage and grain, two to three pounds daily of molasses undoubtedly would prove helpful and economical.

*For fattening Cattle.* — Some three pounds daily may be fed advantageously, especially during the finishing process, when the appetite is likely to prove fickle. The object at such times should be to make the food especially palatable, and thus induce a maximum consumption and also to secure a bright, sleek appearance.

*For Horses.* — In spite of the many reports favorable to the use of molasses for horses, the writer is not inclined to recommend to northern farmers its indiscriminate use in place of the cereals and their by-products. As an appetizer and tonic for horses out of condition, as a colic preventive and for improving the palatability of rations, two to three pounds daily of molasses would undoubtedly prove productive of satisfactory results.

*For Pigs.* — These animals will consume reasonably large quantities of cane molasses daily without ill effects (one pound per one hundred pounds live weight). Small amounts (two to three ounces daily) must be given at first and gradually increased. Molasses must be fed with foods reasonably rich in protein. If skim milk is not available, a combination by weight of two parts bran, one part gluten feed, one part corn meal and one part molasses, or one part tankage, four parts corn meal and one part molasses, ought to prove satisfactory. It is believed that no particular advantage is to be gained by employing molasses for pig feeding other than an appetizer.

The residuum molasses from Porto Rico (blackstrap) is brought in tank steamers and offered in Boston at 14 cents a gallon of 12 pounds in barrel lots. It contains about 1,100 pounds of digestible organic matter in one ton, and as a food has about 75 per cent. of the value of corn meal. The particularly favorable effect of molasses as an appetizer, etc., naturally is not included in the above estimate of its worth ; neither does its lack of protein as compared with corn meal nor the extra cost and bother of handling enter into the calculation.

*The value of molasses feeds* was summarized under composition, digestibility, for milk production and as compared with home-mixed grain rations.

It was shown that these feeds were composed of oat and barley residues, partly ground grain screenings and malt sprouts in many cases, one-fourth to one-third molasses, and sufficient gluten feed and cotton-seed meal to supply the protein guarantied.

The total digestible organic nutrients contained in molasses feeds are in excess of those contained in wheat bran, but noticeably below those contained in flour middlings and gluten feed. The amount of protein contained in bran, middlings and gluten feed is decidedly greater than in the average of the several molasses feeds. The latter class of feeds may be said to be only moderately digestible.

No advantage is to be gained from feeding molasses feeds in place of home mixtures of standard concentrates. Digestible protein in the former feeds is decidedly more expensive, and digestible matter can generally be purchased for less money in the home mixtures.

The fact that many of the prepared molasses feeds contain considerable quantities of unground weed seeds is a decided argument against their use. Weed seeds pass through the animal undigested, and are distributed with the manure and greatly increase the cost of subsequent cultivation.

### *The Digestibility of Proprietary Cattle Feeds.*

A considerable number of mixtures of various by-products are offered as ready rations for dairy stock. Among these may be mentioned Buffalo creamery feed, Chapin's alfalfa meal, Biles union grains, H. O. and Quaker dairy feeds, Protena, Schumacher's stock feed, Sucrene, Green Diamond and Holstein sugar feeds. In addition to an analysis, the *degree of* *digestibility* is quite necessary in order to form an accurate opinion of the true nutritive value of a feed stuff. The station has tested the digestibility of all of the above-mentioned feeds, and intends publishing the detailed results.

The requirements of any ready ration, either mixed at home from standard by-products, or purchased in the form of a proprietary mixture, may be briefly stated as follows: —

1. It should be bulky, palatable, and free from mold and rancidity.
2. It should contain at least 16 pounds of digestible protein in 100.
3. It should contain substantially 70 pounds of digestible organic nutrients in 100, and not over 9 per cent. of total fiber.

The results of our observations and digestion studies have shown that only one proprietary feed — Biles union grains — substantially conformed to the above requirements. This feed contained 17.8 pounds of digestible protein, 66.7 pounds of digestible organic matter and 9.6 pounds of total fiber in 100 pounds. The other feeds showed from 7.5 to 16.1 pounds of digestible protein, from 52 to 62 pounds of digestible organic matter and from 10 to 18 pounds of total fiber in 100. Most of the above feeds are quite expensive as sources of digestible protein, and furnish digestible organic matter at a higher cost than it can be had in the ordinary standard by-products.

### *The Effect of Soy Beans minus the Oil, and of Soy Bean Oil on the Composition of Milk and Butter Fat, and on the Consistency or Body of Butter.*

An experiment was in progress during the winter of 1906-07 to study the physiological effect of this legume upon milk and butter. The experiment is one of a series planned to ascertain the feeding effect of the various groups of substances — protein, carbohydrates and fat — upon milk secretion in general. The beans were shipped to a western oil mill to secure the removal of the oil, the percentage being reduced from 16 to 8. It was hoped that after the extraction the residue would not show over 3 per cent., but this result was not secured. It is intended to publish and discuss the experiment in detail at a future time. The most important results only are now mentioned: —

1. Soy bean meal, after the extraction of oil, had no effect in changing the relative proportions of the several milk ingredients, did not noticeably modify the chemical composition of the butter fat, and exerted no marked influence on the body of the butter.

2. Soy bean oil temporarily increased the percentage of fat in the milk, modified the composition of the butter fat by decreasing the saponification number, the percentage of soluble fatty acids and the percentage of volatile fatty acids; it increased the iodine number from 32 to 40, and hence the olein percentage, but did not change the melting point of the fat. The oil likewise produced a softer, more yielding butter, that would not stand up well at 70° F. and above.

## 12. Work in Progress.

### *Studies in Milk Secretion.*

Two grade Holstein cows are being fed a continuous hay diet during an entire lactation period; two similar cows a hay and moderate grain diet during an entire period of lactation; two Jersey cows — a high grade and a pure bred — are also receiving a hay and moderate grain diet during a period of lactation.

The objects sought are: (*a*) the variations in the chemical composition of the milk and milk fat; (*b*) the milk fat constants; (*c*) the comparative composition of the milk fat from Holstein and Jersey cows under similar conditions of feed and care. It is also intended to observe, so far as possible, the general character of the butter resulting from the hay and from the hay and grain diet. This work will continue until the autumn of 1907.

### *Studies in Soil Analysis.*

Samples of soils from Field A, which is divided into eleven different plots, and which has been under continuous treatment since 1889, are being submitted to a careful examination, to ascertain the chemical variations in the soil resulting from different methods of fertilization. The results thus far secured show very slight differences in the amount of the several constituents present. This work is a part of an experiment under the management of the agricultural department of the station.

### *Effect of Molasses on Digestibility.*

It is a well-known fact that the addition of considerable quantities of starch, sugar and similar substances causes a distinct depression in the digestibility of the substances with which they are fed. By digestion depression is meant the checking of the digestion and an assimilation of the other substances. A number of experiments have been made and others are still in progress to study the influence of Porto Rico molasses on the digestibility of the other ingredients of different rations. The results thus far secured may be stated briefly: —

1. When molasses fed together with hay constituted from 10 to 15 per cent. of the total dry matter of the ration, little if any depression was noted.

2. With molasses composing some 20 per cent. of the dry matter of the hay ration, a depression of 4.5 per cent. was noted in the digestibility of the hay, the digestibility of the dry matter of the latter being 58 per cent. without the molasses, and 55.4 per cent. with the molasses.

3. Molasses and hay would not make a satisfactory combination for any kind of farm stock. A more suitable ration would consist of hay, together with one or more protein concentrates and molasses. Consequently, the effect of the molasses was tested upon a combination of hay and gluten feed. The results of six single trials, in which molasses composed from 17 to 24 per cent. of the dry matter of the ration (average 20 per cent.), show that the dry matter of the combination of hay and gluten without molasses was 72.3 per cent. digestible and 66.5 per cent. digestible when fed with the molasses, hence the molasses caused a depression of 8 per cent. in the digestibility of the hay and gluten.

### *Early Amber Sorghum.*

This plant has again proved its usefulness as a forage crop. Observations have been continued relative to the quantity of seed to be sown broadcast to the acre. Last season as satisfactory results were secured from 60 pounds as from 100 pounds of seed to the acre. The present season three 20-acre plots were each fertilized alike as heretofore and on June 11 the seed was sown broadcast at the rate of 50, 40 and 30 pounds to the acre. In spite of the late seeding and dry August, the crop grew fairly well, and when cut, September 12, was just beginning to head out. The yields, on the basis of one acre, were as follows: —

*Seed per Acre.*

| | 50 Pounds Seed to the Acre. | | 40 Pounds Seed to the Acre. | | 30 Pounds Seed to the Acre. | |
|---|---|---|---|---|---|---|
| | Green (Pounds). | Dry Matter (Pounds). | Green (Pounds). | Dry Matter (Pounds). | Green (Pounds). | Dry Matter (Pounds). |
| Plot 1, . . . . | 32,000 | 6,944.0 | - | - | - | - |
| Plot 2, . . . . | - | - | 29,400 | 6,556.2 | - | - |
| Plot 3, . . . . | - | - | - | - | 28,800 | 6,278.4 |

The yields were not as heavy as were obtained the year previous (20,000 pounds to the acre), owing to the cool, dry August, which did not permit as advanced a development of the crop. From two years' observations it may be concluded that 50 to 60 pounds of seed to the acre are sufficient when sown broadcast for forage purposes. More than this is not necessary; smaller amounts permit a too coarse development of the individual plants, and also gives opportunity for the growth of weeds, especially during the early life of the sorghum plants.

### *Alfalfa in Massachusetts.*

Observations have been continued relative to the suitability of alfalfa as a forage crop in this State. Last year three cuttings were secured from a one-sixth acre plot, equivalent to 3.65 tons of dry hay to the acre (basis of 15 per cent. moisture). The two small plots referred to in the previous report have been combined in one plot one-third of an acre in area. A growth of some 6 to 8 inches was allowed to remain during the autumn of 1906, to serve as a mulch. The plants came through the winter of 1906–07 in excellent condition, and started well in the spring, although the season was some ten days to two weeks late.

The first cutting contained considerable grass in spots, but yielded at the rate of 2.35 tons to the acre. Unfortunately, through an oversight, the weight of the second cutting (made in early August) was not taken. The third cutting (made September 19) stood about 2 feet high and yielded at the rate of 1 ton to the acre. The weather was very bad during the curing of this cutting, the hay standing in cocks under hay caps for two weeks, being shaken out once during that time. In spite of the bad weather condition, it was fairly well cured and the animals ate it readily. The entire yield for the season, on the basis of 15 per cent. water, must have been at the rate of nearly 4½ tons to the acre. In view of the results thus far secured, the writer is inclined to advise farmers to try alfalfa in a small way, to study its peculiarities carefully, and not to be discouraged if success is not attained at the first trial.

### *Cost of Rearing Dairy Stock.*

The station raises one or two dairy calves yearly to keep up its herd which is being used for experiment purposes. An account has been kept of the food cost involved, and, while the data is not sufficiently complete for publication, it may be said that from $40 to $45 represents the cost of food consumed, when figured at market prices, until the animal reaches two years of age. The animals have been pastured during the summer and for the remainder of the year fed on first and second cut hay, some silage and not over two or possibly three pounds of grain daily. The grain ration has usually consisted of a mixture of bran and fine middlings.

# PART II. DAIRY AND CHEMICAL STUDIES.

## 1. THE CHEMICAL COMPOSITION OF MILK.

J. B. LINDSEY.

The larger part of milk consists of water, which contains a variety of substances in suspension and solution. The substances largely dissolved in the water are casein and albumen, milk sugar and the ash or mineral matter, which together form the milk serum.[1] The fat is suspended in the milk in microscopic globules, which are semisolid, and with the serum form what is termed an emulsion.

The multitudinous analyses of milk have shown it to vary widely in composition, depending upon the breed and individuality of the cow, stage of lactation and weather conditions. Food, as a rule, has little effect in permanently changing the proportions of the several ingredients. Numerous authorities state that 100 pounds of milk of average quality should contain the following amounts of the different ingredients: —

| | | Pounds in 100, or Percentage. |
|---|---|---|
| Water, | | 87.00 |
| Fat, | | 4.00 |
| Albuminoids | Casein, | 3.00 |
| | Albumen, | .50 |
| Milk sugar, | | 4.80 |
| Ash, | | .70 |
| | | 100.00 |

The term "total solids" is meant to include all of the ingredients excepting water. For ordinary purposes the chemist determines only the total solids and fat, and obtains the solids not fat by difference. The former two serve as an index of the chemical composition of the milk.

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[1] That portion of the casein which can be removed by filtration through filter paper is not generally included in normal serum.

### *Composition of Milk of Pure-bred Cows.*

The following data have been tabulated from authentic sources, in the hope that they will throw light on the composition of milk produced by distinct breeds of dairy cows : —

#### (*a*) AMERICAN DATA.

#### *1. Jerseys.*

| No. of Cows. | Length of Period. | AUTHORITY. | Total Solids (Per Cent.). | Fat (Per Cent.). | Solids not Fat (Per Cent.). |
|---|---|---|---|---|---|
| 25 | 3 months, . | Chicago Exposition,[1] . . | 14.00 | 4.78 | 9.28 |
| 5 | 6 months, . | Pan-American Exposition at Buffalo.[2] | 13.90 | 4.58 | 9.32 |
| 25 | 4 months, . | Louisiana Purchase Exposition, St. Louis.[1] | 13.50 | 4.70 | 8.80 |
| 3 | One lactation period. | New York Experiment Station.[3] | 15.40 | 5.61 | 9.80 |
| 3 | 8 months, . | New Jersey Experiment Station.[4] | 14.34 | 4.78 | 9.56 |
| | | Average, 61 cows, . . | 13.87 | 4.77 | 9.12 |

#### *2. Guernsey.*

| | | | | | |
|---|---|---|---|---|---|
| 25 | 3 months, . | Chicago Exposition,[5] . . | 13.78 | 4.61 | 9.17 |
| 25 | 6 months, . | Pan-American Exposition at Buffalo.[2] | 13.90 | 4.60 | 9.30 |
| 2 | One lactation period. | New York Experiment Station.[3] | 14.60 | 5.12 | 9.47 |
| 3 | 8 months, . | New Jersey Experiment Station.[4] | 14.48 | 5.02 | 9.46 |
| 2 | Probably 7 days. | Wisconsin Experiment Station.[6] | 14.46 | 5.39 | 9.07 |
| | | Average, 57 cows, . . | 13.92 | 4.67 | 9.25 |

#### *3. Holsteins.*

| | | | | | |
|---|---|---|---|---|---|
| 5 | 6 months, . | Pan-American Exposition at Buffalo.[2] | 12.00 | 3.25 | 8.75 |
| 15 | 4 months, . | Louisiana Purchase Exposition, St. Louis.[1] | 11.30 | 3.40 | 7.90 |
| 70 | Generally 7 days. | Wisconsin Experiment Station.[6] | 11.78 | 3.33 | 8.45 |
| 1 | One lactation period. | New York Experiment Station.[3] | 12.39 | 3.46 | 9.07 |
| 3 | Eight months, | New Jersey Experiment Station.[4] | 12.12 | 3.51 | 8.61 |
| | | Average, 94 cows, . . | 11.73 | 3.34 | 8.39 |

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[1] The Dairy Cow Demonstration, published by American Jersey Cattle Club, 1905, pp. 65 and 71. See also Hoard's Dairyman, Nov. 24, 1893, p. 638. This paper gives 13.71 as the total solids for Jerseys.

[2] DeWitt Goodrich, Official Milk Tester (in Creamery Patrons' Handbook, p. 166).

[3] Tenth report, p. 141.

[4] Report for 1890, p. 223.

[5] Furnished by W. H. Caldwell, secretary, American Guernsey Cattle Club. Hoard's Dairyman gives 13.41 per cent. solids and 4.51 per cent. fat for Guernseys.

[6] Twentieth report, p. 158.

### 4. *Ayrshires.*

| No. of Cows. | Length of Period. | AUTHORITY. | Total Solids (Per Cent.). | Fat (Per Cent.). | Solids not Fat (Per Cent.). |
|---|---|---|---|---|---|
| 5 | 6 months, | Pan-American Exposition, Buffalo.[1] | 12.60 | 3.60 | 9.00 |
| 4 | One lactation period. | New York Experiment Station.[2] | 13.06 | 3.57 | 9.35 |
| 3 | Eight months, | New Jersey Experiment Station.[3] | 12.70 | 3.68 | 9.02 |
| | | Average, 12 cows, | 12.78 | 3.61 | 9.12 |

### 5. *Shorthorns.*

| | | | | | |
|---|---|---|---|---|---|
| 24 | 3 months, | Chicago Exposition,[4] | 12.41 | 3.64 | 8.77 |
| 5 | 6 months, | Pan-American Exposition, Buffalo.[1] | 12.80 | 3.57 | 9.23 |
| 25 | 4 months, | Louisiana Purchase Exposition, St. Louis.[4] | 12.20 | 3.60 | 8.60 |
| 2 | Probably 7 days. | Wisconsin Experiment Station.[5] | 12.60 | 3.52 | 9.08 |
| | | Average, 56 cows, | 12.36 | 3.61 | 8.75 |

### 6. *Brown Swiss.*

| | | | | | |
|---|---|---|---|---|---|
| 5 | 6 months, | Pan-American Exposition, Buffalo.[1] | 12.70 | 3.63 | 9.07 |
| 5 | 4 months, | Louisiana Purchase Exposition, St. Louis.[4] | 12.50 | 3.60 | 8.90 |
| | | Average, 10 cows, | 12.60 | 3.62 | 8.98 |

### 7. *Devons.*

| | | | | | |
|---|---|---|---|---|---|
| 2 | One lactation period. | New York Experiment Station.[2] | 13.77 | 4.15 | 9.60 |

### *Summary American Data.*

| BREED. | Number of Cows. | Total Solids (Per Cent.). | Butter Fat (Per Cent.). | Solids not Fat (Per Cent.). |
|---|---|---|---|---|
| Jerseys, | 61 | 13.87 | 4.77 | 9.12 |
| Guernseys, | 57 | 13.92 | 4.67 | 9.25 |
| Holsteins, | 94 | 11.73 | 3.34 | 8.39 |
| Ayrshires, | 12 | 12.78 | 3.61 | 9.12 |
| Shorthorns, | 56 | 12.36 | 3.61 | 8.75 |
| Brown Swiss, | 10 | 12.60 | 3.62 | 8.98 |
| Devons, | 2 | 13.77 | 4.15 | 9.60 |

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[1] DeWitt Goodrich, Official Milk Tester (in Creamery Patrons' Handbook, p. 166).

[2] Tenth report, p. 141.

[3] Report for 1890, p. 223.

[4] The Dairy Cow Demonstration, published by American Jersey Cattle Club, 1905, pp. 65 and 71. See also Hoard's Dairyman, Nov. 24, 1893, p. 638.

[5] Twentieth report, p. 158.

In addition to the above, F. W. Woll[1] gives the following: —

*Summary of American Analyses for Butter Fat in Milk of Pure-bred Cows.*

| BREED. | No. of Cows. | Butter Fat (Per Cent.). |
|---|---|---|
| Jerseys, | 491 | 4.98 |
| Guernseys, | 191 | 4.77 |
| Holsteins, | 679 | 3.28 |
| Ayrshires, | 108 | 3.84 |
| Shorthorns, | 370 | 3.73 |
| Brown Swiss, | 20 | 3.78 |
| Devons, | 50 | 4.57 |

### (*b*) FOREIGN DATA.

According to Hucho[2] and Koenig,[2] German authorities, the average composition of the milk of different breeds is as follows: —

| BREED. | Total Solids (Per Cent.). | Fat (Per Cent.). | Solids not Fat (Per Cent.). |
|---|---|---|---|
| Holsteins,[3] | 12.00 | 3.25 | 8.75 |
| Ayrshires, | 12.50 | 3.70 | 8.80 |
| Shorthorns, | 12.90 | 3.80 | 9.10 |
| Devons,[3] | 13.40 | 4.40 | 9.00 |
| Jerseys, | 14.70 | 5.00 | 9.70 |
| Guernseys, | 14.70 | 5.00 | 9.70 |

The average breed tests, conducted at the annual dairy shows of the British Dairy Farmers Associations, 1879–98 inclusive, have given the following results: [4] —

| BREED. | Number of Cows | Total Solids (Per Cent.). | Fat (Per Cent.). | Solids not Fat (Per Cent.). |
|---|---|---|---|---|
| Jerseys, | 272 | 14.46 | 4.98 | 9.48 |
| Guernseys, | 98 | 13.50 | 4.61 | 8.89 |
| Holsteins, | 10 | 12.25 | 3.41 | 8.84 |
| Ayrshires, | 42 | 13.29 | 4.19 | 9.10 |
| Shorthorns, | 236 | 12.72 | 3.75 | 8.97 |
| Devons, | 2 | 14.34 | 4.90 | 9.44 |

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[1] Twentieth report, p. 158.

[2] Hatch Experiment Station, Bulletin No. 110, pp. 6 and 7. See also Woll's Handbook, first edition, p. 213.

[3] Koenig, Die Menschlichen Nährungs- und Genussmittel.

[4] Woll's Handbook, fourth edition, 1907, p. 241.

COMPOSITION OF MIXED MILK (LARGELY GRADE COWS, ALL BREEDS).

*American and Foreign.*

| Number Analyses. | AUTHORITY. | Total Solids (Per Cent.). | Butter Fat (Per Cent.). | Solids not Fat (Per Cent.). |
|---|---|---|---|---|
| 793[1] | Koenig,[2] | 12.88 | 3.69 | 9.19 |
| 200,000 | Aylesbury Dairy Company, London,[3] | 12.90 | 3.90 | 9.00 |
| 4,103 | Hatch Experiment Station,[4] | 13.63 | 4.43 | 9.20 |
| 110 | Hatch Experiment Station,[5] | 13.23 | 4.49 | 8.74 |
| 5,552 | Van Slyke,[6] | 12.70 | 3.90 | 8.80 |

Naturally, the larger the proportion of cows in a given area producing thin milk, the nearer will the mixed milk in that area approach 12 per cent. solids; and the larger the proportion of cows in a given area producing thick or rich milk, the nearer will the average of the mixed milk be to 13 per cent. or more of solids.

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[1] Number of cows.

[2] Koenig, Die Menschlichen Nährungs- und Genussmittel.

[3] Dairy Chemistry, Richmond, p. 120.

[4] Eighteenth report, p. 223.

[5] Bulletin No. 110 (Amherst and Northampton Milk Supply).

[6] Modern Methods of Testing Milk, p. 15.

## 2. THE EFFECT OF FOOD UPON THE COMPOSITION OF MILK AND BUTTER FAT, AND UPON THE CONSISTENCY OR BODY OF BUTTER.

J. B. LINDSEY.

The writer, together with a number of co-workers, from time to time has conducted a number of long-continued experiments relative to the effect of food and food constituents upon milk, butter fat and butter. Work of this sort is still in progress. The most important results thus far secured may be briefly enumerated below. The full data of the soy bean experiment have not been published.

### (a) *Effect on the Milk.*

1. Different amounts of *protein* in the daily ration derived from linseed, cotton-seed, soy bean and corn gluten meals, do not seem to have any pronounced effect in changing the relative proportions of the several milk ingredients.

2. *Linseed oil* in flaxseed meal, when fed in considerable quantities (1.40 pounds digestible oil daily), increased the fat percentage from 5 to 5.56, and slightly decreased the nitrogenous matter of the milk. This fat increase was only temporary, the milk gradually returning (in four or five weeks) to its normal fat content. The nitrogenous matter also gradually returned to normal, but more slowly than did the fat.

3. Three pounds of *cotton-seed meal* with minimum oil (8 per cent.), when fed daily to each animal, had no noticeable influence on the composition of the milk.

4. The addition of ½ to ¾ of a pound of *cotton-seed oil* to the cotton-seed meal ration appeared to increase the fat percentage of the milk about .4 of 1 per cent. (5 to 5.4), and this increase was maintained during the six weeks of the feeding period.

5. The substitution of *linseed meal* with a minimum percentage of oil (3 per cent.) in place of the cotton-seed meal and cotton-seed oil resulted in a decline of the fat in the milk to its normal percentage. This change probably was due to the removal of the cotton-seed oil from the ration, and not to the influence of the linseed meal.

6. The addition of .6 of a pound of *corn oil* to a ration made up of a mixture of grains low in fat increased the fat percentage of the milk .23 per cent. (5.17 to 5.40). At the end of two weeks the effect of the corn oil had disappeared, and the milk had returned to its normal fat content.

7. The sudden removal of the *corn oil* from the daily ration caused a drop of .54 per cent. in the fat (4.97 to 4.43), but after the first week the normal fat per cent. was again present.

8. *Corn oil* appeared to have depressed the nitrogen percentage of the milk by .034 per cent. (.610 to .576), the nitrogen gradually returned to its normal percentage after the feeding of the corn oil had ceased.

9. *Corn meal* (a carbohydrate feed) was without effect on the composition of the milk.

10. Two to 3 pounds of *soy bean meal* with a minimum oil percentage (8 per cent.), fed daily to each animal, did not appear to in any way modify the proportions of the several milk constituents.

11. The addition of ½ to 1 pound daily of *soy bean oil* to a basal ration of grain and hay very slightly increased the fat percentage in the milk during the first two or three weeks (.10 per cent.). No other variation was noted.

12. The sudden removal of the *soy bean oil* from the ration caused a drop of .25 per cent. of the fat percentage of the milk. At the end of three weeks the milk had not regained its normal fat percentage.

### (*b*) *Effect on Butter Fat.*

13. *Corn gluten* and *linseed meals* with a minimum percentage of oil (3 per cent.) produced a normal butter fat. *Cotton-seed and soy bean meals* with a minimum oil percentage (8 per cent.) likewise effected little change in the composition of the butter fat. *Corn meal* was without noticeable influence on the composition of the butter fat.

14. *Linseed oil* (1.4 pounds digestible oil per head daily)

produced a noticeable change in the composition of the butter fat, causing a decrease in the volatile acids and an increase in the melting point and olein percentage (soft fat).

15. *Cotton-seed oil* (.5 pound daily per head) increased the melting point and the olein percentage of the butter fat.

16. *Corn oil* (.6 pound per head daily) decreased the volatile fats and increased the percentage of olein; the melting point of the fat remained unchanged.

17. *Soy bean oil* (.50 to 1 pound daily per head) caused a drop in the saponification number of some 10 points, a decrease in the soluble fatty acids and in the volatile fatty acids (Reichart-Meissl number), an increase in the iodine number (percentage of olein) from 32 to 40, while little or no change was noted in the melting point of the butter fat.

18. A rise in the iodine number (increase of olein) is a reasonably sure indication of a soft-bodied butter which will lack in firmness at a temperature of 70° F. An increase in the melting point of the butter fat is not a sure indication of a harder, firmer butter. It seems evident that the proportions of the several fats is more or less changed by an excess of oil in the feed and that this change of proportions varies the melting point in the fat in some such way as the melting point of a mixture of metals is changed by the resulting amalgamation.

### (c) *Effect on Butter.*

19. The effect of *linseed meal* with a minimum percentage of oil (3 per cent.) on the general character of the butter was not positively identified.

20. *Cotton-seed meal* with a relatively high oil percentage (12.6 per cent.) produced butter that was rather crumbly when hard, and slightly salvy to the taste. Cotton-seed meal with a minimum percentage of oil (8 per cent.) likewise produced a hard, firm butter.

21. *Corn gluten meal* with a minimum percentage of oil (2 to 3 per cent.) produced a rather soft, yielding butter.

22. *Soy bean meal* with minimum oil (8 per cent.) produced butter that was rather softer and more yielding to the touch than that derived from a grain ration composed entirely of bran, ground corn and oats, gluten feed and cotton-seed meal.

23. An excess of *linseed oil* (1.4 pounds digestible oil per head daily) produced a very soft, salvy butter, with an inferior flavor.

24. The addition of *cotton-seed oil* (.5 pound per head daily) to a normal ration, or to one containing 3 pounds of cotton-seed meal low in oil, produced a softer, more yielding butter than that produced by the ration with the oil omitted.

25. The addition of *corn oil* (.6 pound daily per head) to a normal ration containing 2 pounds of corn gluten meal low in oil produced a noticeably softer butter than when the oil was omitted.

26. *Corn meal* tended to produce a reasonably hard, firm butter, of an agreeable flavor.

27. *Soy bean oil* (.5 to 1 pound daily per head) added to a grain ration produced a butter that was noticeably soft and yielding to the touch, and that would not stand up well at 70° F. and above.

The experiments thus far completed enable one to draw the following general conclusions: —

1. Neither the *proteid* nor the *carbohydrate groups*, when fed in normal amount, have any noticeable influence in changing the proportions of the several milk ingredients, nor in modifying to any marked degree the character of the butter fat as revealed by the ordinary chemical tests; such changes, so far as they are the result of food, are due to the presence of oil in the feed stuff.

2. Some proteids produce a harder, firmer butter than others, while the tendency of starchy foods is to produce a firm-bodied butter. *Vegetable oils* in excess of the normal amount produce a noticeably soft-bodied butter.

3. It is not considered advisable to feed large quantities of oil to cows, it having a tendency to derange the digestive and milk-secreting organs.

4. The flavor of butter depends primarily on the cleanliness of the milk, stage of lactation of the animal, skill and care of the butter maker, and especially upon the character of the starter employed. Normal feed stuffs must be considered of secondary importance in establishing butter flavor.

## 3. Standard for Babcock Glassware.

E. B. HOLLAND, M.S.

The Massachusetts Legislature, in the spring of 1901, enacted a measure entitled "An Act to provide for the protection of dairymen,"[1] which took effect the first of July of that year. This dairy law, so called, required, among other things, that Babcock glassware should be tested for accuracy, and made it the duty of the director of the experiment station or his agent.[2] The statute designated no standards whatsoever, leaving the matter entirely to the discretion of the experiment station. After visiting several stations and consulting the official having charge of such work, a standard, methods of testing and an allowable limit of error, conforming in general to the requirements of other New England States, were adopted provisionally and published in the fourteenth and fifteenth annual reports of this station.[3]

Up to the end of the last fiscal year (Dec. 1, 1907), 18,855 pieces of glassware had been tested, of which 1,770 pieces, or 9.39 per cent., were condemned. The yearly totals recorded below show marked variations, but with a high average percentage of inaccuracy.

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[1] Acts and Resolves of Massachusetts for 1901, chapter 202, sections 1–7, Revised Laws of Massachusetts for 1902, chapter 56, sections 65–69.

[2] Sections 1, 2.

[3] Hatch Experiment Station, annual reports for 1901 and 1902.

*Amount of Glassware tested.*

| YEAR. | Total Number of Pieces. | Number Inaccurate. | Per Cent. Inaccurate. |
|---|---|---|---|
| 1901, | 5,041 | 291 | 5.77 |
| 1902, | 2,344 | 56 | 2.39 |
| 1903, | 2,240 | 59 | 2.63 |
| 1904, | 2,026 | 200 | 9.87 |
| 1905, | 1,665 | 197 | 11.83 |
| 1906, | 2,457 | 763 | 31.05 |
| 1907, | 3,082 | 204 | 6.62 |
| Totals, | 18,855 | 1,770 | 9.39[1] |

The grand totals may be further subdivided into the several classes of glassware of which they were composed: —

*Character of Glassware tested.*

| KIND. | Total Number. | Number Inaccurate. | Per Cent. Inaccurate. |
|---|---|---|---|
| Cream bottles, | 7,714 | 710 | 9.20 |
| Milk bottles, | 6,826 | 784 | 11.49 |
| Skim milk bottles, | 675 | 106 | 15.70 |
| Pipettes, | 2,834 | 69 | 2.43 |
| Acid measures, | 806 | 101 | 12.53 |
| Totals, | 18,855 | 1,770 | 9.39[1] |

The manufacturers repeatedly protested against the refusal of their glassware, and asserted that similar shipments were passed in other States. Such might easily have been the case, where the error was small, due to differences in method of testing or in allowable limit of error, possibly both. In some instances the condemned pieces were forwarded to another station and retested, but even this apparently failed to satisfy the manufacturers. It became evident that further investigation was necessary in order to bring the matter to an unquestionable basis and to remove all reasonable grounds for complaint.

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[1] Average.

### *Original Standard.*

Dr. Babcock,[1] originator of the method, laid down the following requirements relative to the graduation of bottles: —

> The 10 per cent. of fat represented upon the necks of the bottles correspond to a volume of 2 cubic centimeters.

In addition, this is stated to be equivalent by weight to 2 grams of water or 27.18 grams of mercury (specific gravity 13.59). No mention of temperature being made, presumably 60° F. was intended. This would indicate the Mohr cubic centimeter, and is supported by a statement of the Emil Greiner Company, under date of Dec. 3, 1906: —

> When we made the first bottles for Dr. Babcock, nearly twenty years ago, we were simply told to graduate the space of 2 cubic centimeters into 50 parts, and each five parts representing 1 per cent. butter fat. Therefore, 1 per cent. is .2 of a cubic centimeter, and at that time the Mohr cubic centimeter was considered the standard.

Concerning the graduation of pipettes, Dr. Babcock stated: —

> It should contain, when filled to the mark, 17.6 cubic centimeters . . . (and) . . . will deliver a little less than 17.5 cubic centimeters of milk.

Capacity in Mohr cubic centimeters was evidently the intent of the graduation.

### *Manufacturers' Basis of Graduation.*

The eastern trade in Babcock glassware is largely supplied by three manufacturers, the Emil Greiner Company of New York, Kimball Glass Company of Chicago and Wagner Glass Works of New York. Upon request, the above firms furnished the following data relative to their standards of graduation. The Emil Greiner Company employed the Mohr cubic centimeter (1 gram of water at 15° C.), and calibrated with either water or mercury (specific gravity 13.6 at ordinary room temperature). The Kimball Glass Company used the true cubic centimeter, and calibrated with mercury (specific gravity

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[1] Wisconsin Agricultural Experiment Station, seventh (1890), ninth (1892) and tenth (1893) annual reports.

13.5463 at 20° C.). The Wagner Glass Works reported 1 cubic centimeter as equal to 13.59 grams of mercury at 60° F., which was probably the Mohr cubic centimeter.

The differences were not large or the errors especially serious, but the need of a scientific standard was unmistakable, if uniformity was to be secured with a safe interchange of apparatus. Only the *limit* of error has permitted the interchange of apparatus in the past, which is a point to be noted.

### *Reasons for a New Standard.*

With these facts at hand, it was necessary to submit the case to some recognized authority for a decision, or at least advice as to what action ought to be taken. This plan also seemed the most promising for the reason that the two parties interested, the manufacturers[1] and the State officials,[2] neither agreed with each other nor among themselves as to a standard or methods of testing. The matter was finally referred to the National Bureau of Standards at Washington, as the body best fitted to deal with the case. Director Stratton[3] wrote as follows: —

> We are decidedly of the opinion that there would be less likelihood of errors in milk-testing work if all volumes were expressed in true cubic centimeters. It of course does not make any difference what unit is used, provided the same one is used to measure the milk sample and the fat; but if — as might easily happen — the pipettes used to measure the milk are graduated on one basis and the neck of the flask on another basis, serious errors might be introduced in the result.
>
> Referring again to the question of graduating Babcock ware for testing milk, which we have given some attention, we hope that you will see your way clear to adopt as the unit in this work the true cubic centimeter at 20° C. This, we feel confident, will prevent confusion in the end, by bringing the apparatus used in testing milk and other dairy products in agreement with the volumetric apparatus used by chemists in general. While the practice of using the gram of water at a certain temperature may have possessed some advantages in Mohr's days, we doubt very much whether it would be any convenience to use such units as the gram of water at 15°, 17.5° or 20° at the present time.
>
> The use of the true cubic centimeter is necessary in all absolute work, and it cannot under any circumstances be dispensed with.

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[1] *Loco citato.* [2] Station reports and correspondence. [3] Correspondence.

### *New Standard.*

The recommendation by the Bureau of the true cubic centimeter as the basis of graduation, because it is a well-defined unit, universally recognized, and for uniformity in volumetric apparatus, appeared worthy of acceptance. The standard or basis of graduation was eventually drafted as follows: —

SECTION 1. The unit of graduation for all Babcock glassware shall be the true cubic centimeter (0.998877 grams of water at 4° C.).

(*a*) With bottles, the capacity of each per cent. on the scale shall be two tenths (0.20) cubic centimeter.

(*b*) With pipettes and acid measures, the delivery shall be the intent of the graduation and the graduation shall be read with the bottom of the meniscus in line with the mark.

As the necessary change in graduation is slight and the manufacturers few in number, there appear no serious obstacles in the way of the adoption of the new standard, though one firm opposed it as impracticable.

### *Methods of Testing.*

(*a*) *Babcock Bottles.* — Of the several methods[1] in vogue for testing Babcock bottles, calibration with a weighed amount of mercury was the most sensitive, because of the high specific gravity of the metal. The process had also the advantage of being generally understood and extremely simple. The figures assumed for the specific gravity of mercury, however, have usually been too high. According to the Bureau of Standards,[2] 1 cubic centimeter at 20° C. should weigh in air against brass weights 13.5471 grams. The official method was readily deduced from the above.

SECTION 2. The official method for testing Babcock bottles shall be calibration with mercury (13.5471 grams of clean, dry mercury at 20° C., carefully weighed on analytical balances, to be equal to 5 per cent. on the scale), the bottle being previously filled to zero with mercury.

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[1] Connecticut Agricultural Experiment Station, twenty-fifth (1901) annual report, pp. 280, 281; Vermont Agricultural Experiment Station, fourteenth (1901) annual report, pp. 222, 223; Wisconsin Agricultural Experiment Station, ninth (1892) annual report, pp. 221, 222; tenth (1893) annual report, p. 125; Testing Milk and its Products, fifteenth edition, Farrington & Woll, pp. 47–53; Modern Methods of Testing Milk and Milk Products, L. L. Van Slyke, pp. 45–49.

[2] Correspondence.

The provision as to clean, dry mercury weighed on analytical balances should be carefully observed. The scale equivalent in mercury of the ordinary bottles is stated below, and that of any other percentage can be readily calculated: —

| KIND. | Capacity, in Per Cent. | Grams of Mercury at 20° C. |
|---|---|---|
| Cream bottles, | 50.00 | 135.4710 |
| Cream bottles, | 30.00 | 81.2826 |
| Milk bottles, | 10.00 | 27.0942 |
| Skim milk bottles, | .50 | 1.3547 |

A number of quick methods, that are reasonably sensitive, are employed to cull out the questionable bottles. For such a purpose they are extremely valuable, but they should never be considered official. This idea was incorporated into a section.

> SECTION 3. Optional methods. The mercury and cork, alcohol and burette, and alcohol and brass plunger methods may be employed for the rapid testing of Babcock bottles, but the accuracy of all questionable bottles shall be determined by the official method.

(*b*) *Pipettes and Acid Measures.* — With Babcock pipettes and acid measures, as with other volumetric apparatus of similar character, the *delivery* is, or should be, the intent of the graduation. There has been considerable discussion on this point, but the recognized practice should not be set aside and an exception made in this case. Relative to pipettes, Director Stratton[1] wrote as follows: —

> The basis of test is the actual volume of water *delivered* by the pipette when used in the manner specified under Regulations for Testing.[2]

He also went on to say that, while he could not state in absolute terms the accuracy of such pipettes when used for milk, in his opinion the error would not exceed .1 cubic centimeter. In other words, a 17.6 cubic centimeter pipette would deliver in milk approximately 17.5 cubic centimeters, — what has usually been assumed. Probably this difference with milk is largely due to viscosity, though other factors enter in. Calibration with mercury is not permissible, as it involves many points of uncertain value, and all tests[1] based on *capacity* should be excluded.

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[1] Correspondence.

[2] Circular No. 9, third edition.

SECTION 4. The official method for testing pipettes and acid measures shall be calibration by measuring in a burette the quantity of water (at 20° C.) delivered.

### *Limit of Error.*

The demand of State officials as to accuracy and the claims of manufactures as to their ability to graduate within definite limits agreed very closely, consequently there was little difficulty in presenting figures acceptable to both parties.

SECTION 5. The limit of error.

(*a*) For Babcock bottles, it shall be the smallest graduation on the scale, but in no case shall it exceed five tenths (0.5) per cent., or for skim milk bottles one hundredth (0.01) per cent.

(*b*) For full quantity pipettes, it shall not exceed one tenth (0.1) cubic centimeter, and for fractional pipettes five hundredths (0.05) cubic centimeter.

(*c*) For acid measures, it shall not exceed two tenths (0.2) cubic centimeter.

The new standard was submitted to Dr. Babcock, and passed without criticism. It was also sent to Professor Woll, referee on dairy products for the association of official agricultural chemists, to be presented at the 1907 meeting, but by some oversight was not forwarded to the secretary. It will be offered at the next annual meeting.

It is desired to acknowledge the valuable assistance of the manufacturers, Director Stratton and station officials, for without their co-operation the proposed standard would not have been deduced.

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[1] Connecticut Agricultural Experiment Station, twenty-fifth (1901) annual report, p. 281; Wisconsin Agricultural Experiment Station, ninth (1892) annual report, pp. 222, 223, tenth (1893) annual report, p. 126; Testing Milk and its Products, fifteenth edition, Farrington & Woll, pp. 53, 54; Modern Methods of Testing Milk and Milk Products, L. L. Van Slyke, p. 49.

# REPORT OF THE BOTANISTS.

G. E. STONE, BOTANIST; G. H. CHAPMAN, ASSISTANT.

1. Outline of the year's work.
2. Seed work.
3. Seasonal peculiarities.
4. Premature defoliation of trees.
5. Asparagus rust.
6. Asparagus fusarium.
7. Peony troubles.
8. Potato diseases.
9. Experiments with fungicides.
10. Influence of potash salts on potato scab.
11. Investigations relating to mosaic disease.
12. Some factors which underlie susceptibility and immunity to disease.

## 1. Outline of the Year's Work.

G. E. STONE.

During the past year attention has been given to the following lines of work: correspondence; observations on and investigations of various diseases; seed separation; seed germination and seed purity testing; mechanical analyses of soils; the study of mosaic troubles of tobacco and other crops; the testing of banding substances for trees; investigations of tomato rot; experiments with the spraying of potatoes; the study of the effects of temperatures, moisture, light, etc., on greenhouse crops; and a study of the meteorological conditions affecting plant diseases and the development of crops.

Mr. N. F. Monahan, who has been connected with the department since his graduation in 1903, resigned to take up practical greenhouse and market-garden work, and his place has since been filled by Mr. G. H. Chapman of the class of 1907.

From the pathologist's standpoint every season possesses distinct individuality, and the past season has been no exception in this respect. Since the meteorological conditions are never identical in any two seasons, plant diseases show considerable variation; and, while an exceptionally dry summer like the past may be conducive to the favorable development of some crops, it is also the means of checking that of others by favoring certain plant diseases. The long period of drought was especially severe for lawns, trees and shrubs, the effect being much more pronounced in the eastern than in the western part of the State.

During the year the department has changed its headquarters from the east experiment station to Clark Hall, a new building located on the college grounds, and its equipment has been enlarged to meet the increased demand of certain lines of work.

We have been obliged to sacrifice much valuable time from experiment work, owing to the difficulty experienced in moving and setting up equipment, and it has been necessary to omit certain lines of investigation from this report.

## 2. SEED WORK.

Work has increased in this line to some extent during the past year, 359 samples of seeds having been tested and separated in 1907, as compared with 231 in 1906. During the year many improvements have been made in the appliances used for separating seed. A Bishop & Babcock blower has been installed for the separation of tobacco seed, and altogether much attention has been given to the development of improved apparatus for this work, which has resulted in the production of an exceptionally efficient method. Arrangements have also been made for separating onion seed by electric power. Constantly increasing interest is being shown in seed testing and seed separation, and in this State as well as others considerable interest has been aroused in making people realize the necessity for pure seed.

The following tables give in brief the seed work done in 1907: —

TABLE I. — *Records of Seed Germination, 1907.*

| KIND OF SEED. | Number of Samples. | GERMINATION. | | |
|---|---|---|---|---|
| | | Average Per Cent. | Highest Per Cent. | Lowest Per Cent. |
| Onion, | 40 | 86 | 98.5 | 57 |
| Tobacco, | 2 | 91 | 92 | 90 |
| Corn, | 9 | 63 | 100 | – |
| Timothy, | 4 | 98 | 100 | 96 |
| Celery, | 3 | 83 | 91 | 70 |
| Miscellaneous, | 189 | 44 | 100 | – |
| Total, | 247 | – | – | – |

TABLE II. — *Records of Seed Separation, 1907.*

| KIND OF SEED. | Number of Samples. | Weight in Pounds. | Per Cent. of Good Seed. | Per Cent. of Discarded Seed. |
|---|---|---|---|---|
| Onion, | 27 | 425 | 87.4 | 12.6 |
| Tobacco, | 85 | 47 | 84.5 | 15.5 |
| Total, | 112 | – | – | – |

The average germination of onion seed for 1907 was 86 per cent., and that of the preceding year 79 per cent., showing a better grade of seed for 1907 than 1906, so far as its germinating capacity is concerned. Some of the corn sent in did not germinate with repeated tests, which was apparently due to the immaturity of the seed.

The miscellaneous seeds in this list consist largely of flower and vegetable seeds. Some white pine seeds were tested, the per cent. of germination being 59, while frequently white pine seeds do not give more than 33 per cent. of germination.

Only 4 per cent. was discarded from the best tobacco seed by the process of air separation, while from the poorest sample 33 per cent. was discarded. At the present time most tobacco men grow their own seed, selecting carefully those plants representing the best types of tobacco; consequently, the seeds which are sent to us contain considerable chaff, which is blown out and included in the percentage of discarded seed. By this process of selection a more uniform type of tobacco is obtained and improvements in the crop rendered possible.

In the case of the best onion seed 1.6 per cent. was discarded by the use of the winnowing machine and 43.3 per cent. from the poorest sample.

The separation of tobacco and onion seed is quite generally acknowledged to be a wise course, and it is being practised extensively among growers in the Connecticut valley. In our opinion, this discarding of the inferior seed should be given more attention.

Seed to be tested or separated should be sent by either mail or express to G. E. Stone, Massachusetts Agricultural Experiment Station, Amherst, Mass. The work is done gratuitously by the station for people living in the State, but the postage or express charges should be paid by the person sending the samples.

### 3. Seasonal Peculiarities.

The extreme conditions which have prevailed during the past four years have been the cause of much injury to vegetation. In previous reports attention has been called to some of these troubles, more particularly to the extensive winter-killing which caused so much injury during the winter of 1903–04, at which time thousands of trees and shrubs were severely affected, many having been dying slowly ever since. Besides the trees which are dying, there are many others which are in a very weakened condition. Numerous oaks which were injured four years ago have died during the past two years, and some of those not yet dead are gradually becoming weaker. These trees are more noticeable in the eastern part of the State, and our attention has repeatedly been called to the serious condition of the elms, due to the same cause. Some very large specimens of this tree have died, and others are in poor condition.

Mention has previously been made in our reports of the condition of the red maples, many of which are now gradually dying, and the white and rock maples are suffering to a limited extent from the same cause. During the past spring some damage was done to the foliage of these trees by the late frosts.

The condition of the white pine roots has already been referred to a number of times in previous reports. Examinations of these have for the past four years been repeatedly made in various parts of the State, and it has been found that the injury to the fibrous roots is largely responsible for the poor condition of the foliage; but the present condition of the pine roots is much more alarming, since during the past year in a very large number of cases the small feeding roots have collapsed. This is true not only of those trees which show injury from sun scorch, but of those which appear to be perfectly healthy.

Our extensive observations connected with the effects of meteorological conditions on plants have led us to examine hundreds of roots in different localities, and we have found this poor condition of the roots to be widespread and serious. The injury involving the larger fibrous roots was observed extensively four years ago, but that affecting the smaller fibrous roots was not noted in connection with the pine until last summer.

### *Sun Scald.*

The trunks of many apple trees which were affected by sun scald four years ago may be noticed at the present time. Two years ago a great many apple trees again showed the effects of sun scald, which was in many cases followed by canker, and this is very noticeable throughout the State on those trees which have not been pruned. It affected only the lower, shaded limbs, however, and is of little importance, being scarcely perceptible in properly pruned and well-cared-for orchards. The sun scald of two years ago affected many of our wild plants, causing much injury to the wild cornels, particularly to *Cornus stolonifera*, Michx., and *C. circinata*, L'Her.

During the past spring practically every sycamore lost its leaves when they were half grown, from the same cause, and an examination of the young wood of the sycamores showed that all last year's growth was injured; but as the sycamore is a difficult tree to kill by defoliation, from whatever cause, buds were thrown out from the old twigs, and the trees subsequently bore a good crop of foliage. The sycamore often becomes defoliated in early summer from the effects of the fungus *Glœosporium nervisequum* (Fckl.) Sacc., but always succeeds in providing itself with new foliage in a short period of time. Sun scald is a common trouble, and can be easily produced in the laboratory. Our attention has often been called to the sun scald of apple trees, caused by banding with tarred paper, showing that tarred paper should not be used around apple trees without taking precautions.

### *Sun Scorch.*

The past season has been very favorable for sun scorch, this trouble having been much more severe in the eastern part of the State, where the effects of the drought were more marked. Sun scorch is prevalent every summer on certain trees, especially those located in dry soil, and rock maples are peculiarly susceptible in this respect. This season the white pine also sun scorched badly, the injury appearing to be much more general than that which occurred three years ago, but less severe on the foliage, since in practically all cases the burning was confined to the apical portion of the needle, and seldom extended to the base. If the needles are not wholly destroyed, no great injury results, and a large number of the trees which were burned three years ago have entirely recovered. Should nothing further affect the pines, and the condition of the roots improves, the present burning will be scarcely perceptible one year from now, as it is a matter of general observation that many of the trees which burned this season commenced to recover a few weeks after being affected.

Strong, dry winds are important factors in producing sun scorch, and an excellent illustration of this may be found in the ninth annual report of the Hatch Experiment Station (pp. 81, 82); but, technically speaking, the cause of sun scorch is the exhalation of watery vapor from the foliage in excess of the amount of water supplied by the roots. Sun scorch is a common phenomenon, peculiar to many plants, and, while its occurrence on the pine appears to be new to most people, we have observed it for twenty-five years to a very limited extent. The cause of the recent sun scorch of the maple and white pine is to be found in certain meteorological conditions, but the immediate cause may be traced to the peculiarly dry winds of July, together with the inability of the roots to supply sufficient water. The effect of sun scorch is more marked on the western side of a tree or forest, — a fact which has been noted by various observers besides ourselves.

### 4. Premature Defoliation of Trees.

The premature defoliation of trees, which has been very common this season and which occasioned considerable correspondence, as usual, gives rise to much unnecessary anxiety. Among the many well-known causes of defoliation may be mentioned severe drought, and even excess of water may cause it. Elm trees, however, are likely to lose their leaves both in early summer and fall, and this is also common to other trees; but the loss of foliage in the case of the elm is seldom serious enough to cause alarm; and even the shedding of the twigs of the elm, which occurs to considerable extent, often periodically, generally causes little damage.

### 5. Asparagus Rust.

This disease has been more prevalent than usual the past summer in certain localities, but less so in others. It has in some places affected those beds which in ordinary seasons seldom show outbreaks except in the late fall. The rust occurred in a rather unusual form for this section, since as a rule the summer stage (uredospore), which causes practically all the injury, was checked, and as a result the fall stage (teleutospore) developed early in the summer. This often occurs on beds which never suffer materially from the rust, but it is the first instance noticed in this section of the uredospore stage being supplanted by the teleutospore stage in midsummer on beds which are usually infected with the uredospore stage, and which suffer more or less loss from such infection. This supplanting of the summer stage by the fall is an advantage to the crop, as the fall stage causes little damage, and there is not the slightest opportunity for infection during the summer, as the teleutospores do not germinate until they are given a resting period. Prof. R. E. Smith[1] has shown that this often occurs in California, attributing it to a lack of atmospheric moisture.

### 6. Asparagus Fusarium.

During the past few years our attention has been called to an apparently new fungous trouble affecting asparagus, which has appeared in some instances in the spring, attacking the fresh, marketable shoots. On one bed it occurred two years ago, but the owner has not been troubled with it since. In this case the young, tender shoots rotted off near the surface of the ground, and an examination of the soft rot in the tissue revealed that the asparagus shoots were infected with a species of fungus known as fusarium. Many instances of fusarium infection have also been observed by us later in the season on the mature stalks, the infected stalks being contorted in their growth and often split open, and an examination of these stalks always reveals a dense growth of this fungus.

### 7. Peony Troubles.

For two years we have had complaints in regard to a serious trouble of the peony, concerning which much has been written in the florists' journals. The disease is characterized by the dying of the plant to the ground, and an examination of the portion under ground usually reveals a decidedly bad state of affairs. In most of the specimens examined, the crown of the plant, which is located just below the surface, is more or less blackened and decayed, and often dead, the black areas and decayed spots frequently extending below the crown of the plant for some distance. Microscopic examinations of the rather limited material which we have had at hand have revealed no specific organisms associated with this trouble, although fungi, bacteria and eel worms are usually found in the decayed tissue, apparently as secondary factors or accompaniments of decay. In one instance plants were observed which had perfectly clean cavities in the crown, as though eaten out by some small animal ; and in other instances the so-called club-foot or gall formation, containing eel worms, was noticeable on the roots, but these did not seem to be responsible for the trouble. Further investigations of this disease are at present under way.

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[1] The Water Relation of *Puccinia Asparagi*. R. E. Smith, Bot. Gaz., Vol. 38, July, 1904, pp. 19–43.

### 8. Potato Diseases.

Potato foliage went through the season with comparatively little disease. There was no blight of any importance. Some potato crops always die down or mature earlier than others, which is due in part to the conditions under which they are grown, though it is often believed that this early maturity is caused by some blight. The abundance of rain in the fall, which followed the long drought, caused potatoes to rot badly in some cases, especially when located on low and not easily drained soil, but on the whole the season was favorable for potatoes, the dry summer holding in check certain fungi which are likely to be troublesome, especially during a wet summer. On some fields, late in the season, following the period of rain, a rather unusual outbreak of *Cladosporium fulvum*, Cke., occurred, although this fungus is usually confined to tomatoes in this section.

### 9. Experiments with Fungicides.

Some potato-spraying experiments were made on the station plots, for the purpose of testing and comparing certain spraying mixtures to discover their adhesive properties, as well as their value as fungicides. As there was little fungous infection on the potato during the summer, the deductions which were drawn from the various applications of fungicides are not of great value.

The plots selected were those which were being used in the agricultural department for testing the relative value of potash compounds,[1] and for our purposes five of these were used. With the exception of two plots, the standard Bordeaux mixture formed the basis of the fungicides, the regular 4 — 4 — 50 formula being used. The plots were tested as follows: —

Plot 1 was treated with Bordeaux and Paris green, 1 pound of Paris green being added to 50 gallons of the Bordeaux.

Plot 2 was treated with Bordeaux and "Disparene," or arsenate of lead, 5 pounds of "Disparene" being added to 50 gallons of the Bordeaux.

Plot 3 was treated with Bordeaux and sodium benzoate, 4 to 6 ounces of the sodium benzoate being added to 50 gallons of the Bordeaux mixture.

Plot 4 was treated with soda Bordeaux and Paris green, 1 pound of Paris green being added to the soda Bordeaux mixture.

The soda Bordeaux is made as follows: —

| | |
|---|---|
| Soda (commercial lye), . . . . . . | 2 lbs. |
| Copper sulfate, . . . . . . . | 6 lbs. |
| Lime, . . . . . . . . | ½ to ¾ lbs. |
| Water, . . . . . . . . | 60 gals. |

The mixture was tested to insure its alkalinity, and the amount of lime was modified according to the strength of the lye.

Plot 6 was treated with copper phosphate and "Disparene." Copper phosphate is a compound prepared by the Bowker Chemical Company, and is being tested as a fungicide. Our formula is as follows: —

| | |
|---|---|
| Copper phosphate, . . . . . . . . | 5 lbs. |
| "Disparene," . . . . . . . . . | 5 lbs. |
| Water, . . . . . . . . . | 50 gals. |

The plots were sprayed July 6, when the sun was shining, in the order given in the outline, the ordinary barrel spray pump being used. No rain fell before the first observations were made on July 11. The potato bug and flea beetle were present in abundance before the plants were sprayed. The results of the observations of July 11 are given below: —

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[1] See report of the agricultural department, p. 39.

*Plot 1. Bordeaux and Paris Green mixed:* —

No live potato bugs found.

The flea beetles scarce.

The mixture colored the leaves well.

*Plot 2. Bordeaux and "Disparene" mixed:* —

No live potato bugs found.

Flea beetles scarce.

The mixture seemed to adhere rather better than the Paris green, and covered the plants more evenly.

*Plot 3. Bordeaux and Sodium Benzoate:* —

A few potato bugs found on this plot.

Flea beetles scarce.

Color not very strong.

The mixture adhered well.

*Plot 4. Soda Bordeaux and Paris Green:* —

No potato bugs found.

No flea beetles found.

No strong color shown on plants.

*Plot 5. Copper Phosphate and "Disparene":* —

No potato bugs found.

Flea beetles very scarce.

Mixture does not color plants to any appreciable extent.

Although careful observations were made from day to day on the general appearance of the field, and the presence and absence of bugs noticed, by the time set for a second spraying no material difference in appearance was noticeable. Without exception the plants maintained the same condition, *i.e.*, they were free from potato bugs and flea beetles. One plot, that on which sodium benzoate was used, did seem toward the last to have rather more flea beetles and potato bugs than the others, although these were not in sufficient numbers to do any but local damage. There was absolutely no sign of burning of the leaves or stems on any of the plots.

The field was sprayed as before for the second time on July 22. The night after the spray was applied it rained heavily, and most of the spray was apparently washed off; but when the field was examined on July 29 no potato bugs were found, and there was no sign of blight. There was no appreciable leaf burning except in a few isolated cases, and in all these the plants affected were small and weak, and had not made the growth of the others.

One week later the field was sprayed for the last time, as after this the plants became too large to be sprayed again. During the month of August the plants were inspected from time to time, but no late blight (*Phytophthora infestans*, (DBy) ) occurred. In the first week in September, however, a disease appeared which seemed to make headway on some parts of the field, although of no general occurrence on potatoes. This was *Cladosporium fulvum*, Cke. A period of wet weather lasting about a week and a half occurred just after the Cladosporium was noticed, and under these favorable conditions the disease spread rapidly in some sections of the field.

No more observations were taken of the plots until September 16, when the field was again examined carefully, both with reference to the diseases present, the general appearance of the plots and the maturity of the plants. These results were the last taken before the potatoes were dug, and are given below.

Regarding the diseases present on the different plots treated with the spraying mixtures, it was found that plot 1 sprayed with Bordeaux and Paris green, showed the presence of both Alternaria and Cladosporium, although these diseases were found only in localized areas, and could not be considered as especially destructive to the plants. The Bordeaux and Paris green is productive of fairly good results, but does not prove to be so efficacious as some of the mixtures used on the other plots.

Plot 2, treated with Bordeaux and "Disparene," presented a better appearance than did plot 1, and showed very little Cladosporium or Alternaria. This was due to the fact that the mixture adhered to the leaves for a longer time, and was not so easily washed off as the Paris green-Bordeaux mixture.

Plot 3 was sprayed with Bordeaux and sodium benzoate, and the plants proved to be in exceptionally fine condition, practically no Alternaria or Cladosporium being found even on dead plants. This mixture, although not coloring the leaves to any appreciable extent, seemed to adhere better than any of the others, with the exception of that used on plot 4.

Plot 4 was sprayed with soda Bordeaux and Paris green, and when the observations were taken showed no Alternaria or Cladosporium, the whole plot presenting a good appearance. This mixture adhered to the leaves the best of any and possessed the advantage of not coloring the plants to any great extent.

Plot 5 was sprayed with copper phosphate and "Disparene," and was in very poor condition when examined. The whole plot was badly affected with both Alternaria and Cladosporium, and little good seemed to result from spraying with this mixture.

The following table shows the relative appearance of the sections of each plot: —

TABLE III. — *Showing the Relative Difference in the Condition of Each Plot, Sept. 16, 1907.*

| Section. | TREATMENT. | PLOT 1. | PLOT 2. | PLOT 3. | PLOT 4. | PLOT 5. |
|---|---|---|---|---|---|---|
| | | Bordeaux and Paris Green. | Bordeaux and "Disparene." | Bordeaux and Sodium Benzoate. | Soda Bordeaux and Paris Green. | Copper Phosphate and "Disparene." |
| Section 1, | No potash, . . | ½ dead, | All dead, | All dead, | All dead, | All dead. |
| Section 2, | Kainit, . . . | ¾ dead, | ¾ dead, | ¼ dead, | ½ dead, | ⅜ dead. |
| Section 3, | High-grade sulfate of potash. | ¾ dead, | ½ dead, | ¼ dead, | ¼ dead, | ¾ dead. |
| Section 4, | Low-grade sulfate of potash. | ½ dead, | ½ dead, | ¼ dead, | ½ dead, | ⅞ dead. |
| Section 5, | Muriate of potash, . | ¾ dead, | ¾ dead, | ⅜ dead, | ⅜ dead, | ¾ dead. |
| Section 6, | Nitrate of potash, . | ½ dead, | ½ dead, | ⅜ dead, | ½ dead, | ¾ dead. |
| Section 7, | Carbonate of potash, | ¼ dead, | ¾ dead, | ½ dead, | ½ dead, | ¾ dead. |
| Section 8, | Silicate of potash, . | ⅜ dead, | ⅛ dead, | ¼ dead, | ¼ dead, | ⅞ dead. |

Of the different spraying treatments the copper phosphate shows the largest percentage of dying plants, and, as already stated, this plot was the most severely affected with fungi. The other plots which showed less infection were treated with Bordeaux mixture in some form of combination. The application of Bordeaux mixture is known to prolong the maturity of crops, and no doubt the difference in the maturity of the plots treated with the Bordeaux mixture and those treated with copper phosphate is due in part to the tonic effect of the Bordeaux. Too much reliance, however, cannot be placed upon these conclusions as they represent only one season's work, and the following summary must be interpreted with caution.

### *Summary.*

I. Of the sprays used this year on the experimental plots, the soda Bordeaux and Paris green was the best. It adhered to the leaves the best of any used, it did not color the foliage greatly, and effectively prevented the plants from being injured by either fungi or insects. In mixing this spray, however, *great care should be taken to add sufficient lime to make the mixture slightly alkaline, otherwise serious leaf burn might result.*

II. Bordeaux and sodium benzoate ranked a close second in effectiveness, and hardly any discrimination can be made between the soda Bordeaux mixture and the benzoate mixture. This mixture colors the leaves scarcely at all, and adheres about as well as the soda Bordeaux. The sodium benzoate could be added in slightly larger amounts without injury to the plants.

III. Bordeaux and "Disparene" seemed to be productive of fairly good results, and held the blight and insects well in check. It did not, however, give such good results as the first two mentioned. It showed up well on the foliage, coloring it heavily, and it adhered well to the leaves.

IV. Bordeaux and Paris green did not seem to hold the diseases in check as well as some of the other sprays, and did not adhere as well to the leaves; nevertheless, it was productive of good results.

V. Copper phosphate and "Disparene" seemed to have no appreciable effect on checking the disease, and this year's results, at least, seem to indicate that it is not equal to other fungicides.

### 10. INFLUENCE OF VARIOUS POTASH SALTS ON POTATO SCAB (*Oospora scabies*, Thaxter).

In connection with the preceding spraying experiments on potatoes, observations were made on the occurrence of potato scab in the various plots treated with different combinations of potash.[1] As previously stated, there were five series, each containing eight plots, fertilized with seven different potash compounds, with normal or untreated rows between the fertilized ones. Potato scab has been slowly working its way into these plots since the experiment was started a few years ago, although the seed potatoes were treated with the standard corrosive sublimate solution before being planted. Notwithstanding this, potato scab developed quite severely on some plots, and the following table shows to what extent. No stable manure has been applied to these plots, hence that source of contamination has been eliminated.

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[1] See report of agriculturist, p. 39, for details as to fertilizer.

TABLE IV. — *Showing the Development of Scab on Plots treated with Different Potash Compounds.*

| FERTILIZER USED. | Amount of Scab (Per Cent.). |
|---|---|
| No potash, | 5.0 |
| Kainit, | 2.0 |
| High-grade sulfate of potash, | 1.0 |
| Low-grade sulfate of potash, | 1.2 |
| Muriate of potash, | – |
| Nitrate of potash, | – |
| Carbonate of potash, | 95.0 |
| Silicate of potash, | 3.0 |

The above estimates of proportion of tubers affected by scab is based upon observations upon the fourth and fifth series of plots. The relative abundance of the disease in other plots was similar, but the proportion of scabby potatoes was larger.

The results given in this table show that there is a marked difference in one instance of the development of potato scab which can be traced directly to the fertilizer employed. It should be noted in this connection that the results in the different plots are very uniform, practically all the potatoes in the carbonate of potash plots showing much scab, and it is quite evident that this fertilizer is favorable for the development of scab. It is also clear that the corrosive sublimate method of treating the seed potatoes, as well as any other similar method of treatment, is of little value when the soil conditions are especially favorable for the scab fungus. The muriate and nitrate of potash plots did not seem to have developed the scab, and undoubtedly much can be accomplished in holding the disease in check by applying fertilizers which are unfavorable to the growth of the fungus. Wheeler, Hartwell, Sargent and Towar,[1] who have investigated this subject, have shown that acid soils restrict, while lime, ashes, etc., increase, the amount of scab. Dr. Wheeler points out that sulfate of potash, kainit and muriate of potash, in connection with dissolved phosphates, etc., will benefit the soil and render infection less prevalent.

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[1] *Cf.* various articles by H. J. Wheeler, J. D. Towar, B. L. Hartwell and C. L. Sargent, in Bulletin No. 26, 1893, No. 33, 1895, and No. 40, 1896, Rhode Island Experiment Station.

## 11. INVESTIGATIONS RELATING TO MOSAIC DISEASE.

G. H. CHAPMAN.

### *The Mosaic Disease of Tomato and Tobacco.*

Work on this disease was taken up for the first time at the station in July, 1907; too late in the season to observe the seed beds and the transplanting of field-grown tobacco in its natural state. However, the work of the past year has been more in the nature of verifying the results obtained by other investigators than in research purely, so only a preliminary report can be made at the present time.

The disease occurs on several plants, but seems to be most injurious to tobacco, although it has been found that in the case of greenhouse-grown tomatoes a heavy pruning back will bring on the disease, and, as observed at this station, lessens production.

All investigators agree that the mosaic disease is a purely physiological one, but there seems to be much doubt as to whether it is infectious or contagious in character, or both. There also seems to be some difference in opinion as to the direct cause of the disease. In tomatoes it is always produced when the vines are heavily pruned, and in the work here it has been shown that it is connected in no way with methods of transplanting the young plants, and only results from subsequent pruning.

It has been found that tobacco is much more susceptible under conditions which tend to produce the disease than is the tomato. In the case of tobacco, A. F. Woods[1] found that when a plant was grown in soil containing small roots of diseased plants the disease always occurred sooner or later. In our observations on the tomato we have been unable to verify this statement, as in no case has the disease appeared when normal plants were grown in soil which contained roots of plants which had been badly diseased, and in the growing of tomatoes year after year in the station greenhouses there has never been the slightest evidence of infection arising from the soil.

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[1] Mosaic Disease of Tobacco. A. F. Woods, Bulletin No. 18, Bureau of Plant Industry.

In the case of tomatoes grown under glass the disease did not make its appearance when the plants were left normal, but occurred when the plants were pruned. These conditions held true for soils in which there were diseased roots, as well as for those in which tomatoes had not previously been grown.

In the coming year the work will be renewed, and the disease studied under field conditions in the case of tobacco, and experiments carried on to determine the possibility of its occurrence in the seed bed and also after being transplanted from the seed bed to the field. It is thought that the conditions under which the transplanting takes place may account for the presence of this disease in some cases. One case, at least, has come to our notice which seems to indicate that the disease may result from improper handling. In the particular case referred to, two lots of plants were taken from the same seed bed. One lot was well moistened before being removed, and the second lot was removed in a dry condition. The same machine planted both lots, and it was reported that at least 70 per cent. of the plants removed from the seed bed in the drier state became more or less diseased, while of those properly removed and carefully handled only two or three plants became affected. It has also been frequently observed, in connection with the transplanting of aster seedlings from the same bed under identical conditions, that one lot will show the "yellows" badly, and another lot scarcely at all when transplanted into different localities.

In connection with the field work, experiments of a more technical character will be carried on in the laboratory, with a view to ascertaining the effects which different enzymes (oxidase, peroxidase, catalase, etc.) found in growing plants have upon the production of the disease. Woods[1] infers that oxidase and peroxidase play an important rôle in the development of this disease; but in the work so far carried on in the laboratory at this station it seems more probable that catalase has more to do with the production of a diseased condition. This bears out Loew's[1] hypothesis to a great extent, as in the preliminary work here it has been found that catalase is present in far greater quantity in healthy plants than in diseased plants. However, this point cannot be considered proved, as enough work has not yet been done to warrant such a statement. The results so far obtained will be found in this report.

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[1] Mosaic Disease of Tobacco. A. F. Woods, Bulletin No. 18, Bureau of Plant Industry, United States Department of Agriculture.

### *Description of Mosaic Disease on Tomato.*

The appearance of this disease has been described by many investigators, and nearly all have described it in a similar manner, but more particularly with reference to tobacco than to the tomato. The general characteristics of the disease are the same for both plants, but some difference is found in its appearance in extreme cases on the tomato, as will be noted from the following description: —

In the first stages of the disease the leaf presents a mottled appearance, being divided into larger or smaller areas of light and dark-green patches. At this point, however, no swelling of the areas is noticeable, but as the disease progresses the darker portions grow more rapidly, while the light-green areas do not grow so rapidly, and leaf distortion is brought about. In the tomato the light-green areas become yellowish as the disease progresses, and in badly affected plants become finally a purplish-red color. This purplish coloration is found principally on plants which are exposed to strong light, but does not always occur, as it has been found that sometimes, even in badly infested plants, the disease may reach its maximum without showing any reddish coloration whatsoever. The reddish appearance is noticeable only on the upper surface of the leaf, and appears to extend only through the palisade cells. As yet no investigation has been made with reference to its character, but from its appearance under the microscope it is thought that it may be due to the breaking down of the chlorophyll granules, as a result of the diseased condition of the leaf.

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[1] Catalase, Oscar Loew, Report No. 68, Department of Vegetable Pathology and Physiology, United States Department of Agriculture.

Under all conditions of disease, however, the leaves are much distorted and *stiff*, and often very badly curled, never possessing the flexibility of healthy, normal leaves.

### *The Growing of Plants used in Experiments.*

As the mosaic disease seldom if ever occurs on field-grown tomatoes, and as these experiments were carried on in the greenhouse, a standard greenhouse variety of tomato, the Lorillard, was used in the work. This variety is of medium size, and possesses strong growing qualities.

The seed used was carefully selected and of uniform size, all being over 2.5 millimeters in diameter. The seed was first planted in drills in a seed plot in which no tomatoes had previously been grown, and which could in no way contain any roots, decayed or otherwise, of diseased plants. After the seedlings had reached a height of 4-6 centimeters they were transplanted to 4-inch pots, and then once more transplanted, when they had reached a height of 15-18 centimeters, to the boxes containing the coal ashes, mention of which will be made later, and to the benches into soil which had not previously produced tomatoes.

The plants transplanted to the boxes were used to ascertain the action of excess of various plant fertilizers on the production or intensifying of the disease after it had once been contracted. The plants transplanted to the benches were used for inoculation and various other minor experiments.

### *Action of Excess of Fertilizers on the Production or Intensifying of Mosaic Disease.*

To test the action of excesses of various fertilizers on the pruned and unpruned tomato plants, a fertilizer containing all the necessary plant food for tomatoes was used. The fertilizing constituents in tomatoes, given in parts per thousand, are as follows:[1] —

| | Parts. |
|---|---|
| Moisture, | 940.0 |
| Nitrogen, | 1.7 |
| Ash, | – |
| Potassium oxide, | 3.6 |
| Sodium oxide, | – |
| Calcium oxide, | .3 |
| Magnesium oxide, | .2 |
| Phosphoric acid, | .4 |

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[1] Hatch Experiment Station report, 1902.

A fertilizer of the following composition was used, applied in the indicated amounts per acre: —

| | Pounds. |
|---|---|
| Nitrate of soda, | 400 |
| Superphosphate of lime, | 1,320 |
| Muriate of potash, | 280 |
| Lime, | 1,000 |

In order to be certain that the production or reduction of the mosaic disease was due to the excess of fertilizer which was added in each case, a growing medium was taken which contained little or no plant food. In this case pure anthracite or hard coal ashes, which had been sifted through a one-fourth-inch sand sieve, were used.

Five wooden boxes of the same dimensions (45 by 45 by 30 centimeters) were filled to a depth of 25 centimeters with the ashes; to this was added in each case the requisite amount of the complete fertilizer calculated from the above formula. Box 1 contained the complete fertilizer, and nothing else; to box 2 was added an excess of nitrates equal to that already in the fertilizer; to box 3 was added an excess of potash equal to that already in the fertilizer; to box 4 was added an excess of phosphate equal to that already used; and to box 5 was added an excess of lime equal to that already used, — so that the boxes contained: —

*Table showing Contents of Each Box.*

Here n represents the normal amount of fertilizer.
N represents the nitrates.
$K_2O$ represents the potash.
$P_2O_5$ represents the phosphoric acid.
CaO represents the lime.

| NUMBER OF BOX. | Coal Ashes. | N. | $K_2O$ | $P_2O_5$ | CaO |
|---|---|---|---|---|---|
| Box 1, | n | n | n | n | n |
| Box 2, | n | n + N | n | n | n |
| Box 3, | n | n | n + K | n | n |
| Box 4, | n | n | n | n + $P_2O_5$ | n |
| Box 5, | n | n | n | n | n + CaO |

Two tomatoes were planted in each box, one being pruned and the other not. They were allowed to grow for one week, however, before the first pruning, then one plant in each box was cut back to a point about 2 centimeters above the first leaves. In from one to two weeks all the pruned plants showed symptoms of the disease on the new growth, and continued to show it throughout the growing season. None of the unpruned plants showed the slightest indication of the mosaic trouble at any period of growth.

There appeared to be no difference in the intensity of the disease in any of the boxes, and when the diseased plants in the boxes were compared with plants of the same age grown in soil and pruned back at the same time, no difference in intensity of the disease could be noticed, so it would appear from this experiment that *excess of plant food* will not produce or intensify the mosaic disease of the tomato, although it has been observed that an excess of nitrogenous fertilizers does intensify the disease in tobacco, as well as that an excess of lime tends to lessen it,[1] and there are characteristics displayed by plants resulting from overfeeding which resemble the mosaic trouble. In our experiments with the disease on tobacco these views have been borne out, and it has also been noted that the tobacco is far more susceptible to those changes which bring about the disease than is the tomato.

### *Catalase in Tomato Leaves.*

Some leaves of a perfectly normal tomato plant were treated to ascertain the presence or absence of the enzyme catalase, which has been so well described by Loew,[2] as it occurs in tobacco. As only green tomato leaves were available, they were taken and ground up in a mortar with fine quartz sand and a little water. After the leaves were in this manner thoroughly disintegrated the mass was covered with a .2 per cent. solution of ammonium carbonate $(NH_4)_2CO_3$, and set aside for three hours in a room the temperature of which was 25° C. After standing for this length of time the mixture was filtered through a coarse filter, and the resultant mixture filtered again through a finer filter paper.

The residue, consisting of pulp and quartz sand, was allowed to stand for a short time to thoroughly drain, and the filtrate was treated with dilute acetic acid 1 : 4. The filtrate was greenish in color, and when acted upon by the acetic acid a flocculent precipitate was obtained which was also greenish in color, — whether due to impurities or pulp is a question.

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[1] Mosaic Disease of Tobacco. A. F. Woods, Bulletin No. 18, Bureau of Plant Industry, United States Department of Agriculture.

[2] Catalase. Oscar Loew, Report No. 68, Department of Vegetable Pathology and Physiology.

A portion of unfiltered juice was also saved for treatment. A diluted solution of commercial hydrogen peroxide ($H_2O_2$, containing 3 per cent. of pure $H_2O_2$) was treated with a small amount of the residue obtained from the first filtration. An abundant evolution of oxygen gas resulted, showing that catalase was present, in insoluble form, at least. The insoluble catalase has been called by Loew $\alpha$ catalase. As no other known enzyme will break down hydrogen peroxide ($H_2O_2$) in this manner, it is safe to say that catalase was present.

The first filtrate was added to a diluted solution of hydrogen peroxide, and a somewhat smaller amount of oxygen relatively was evolved. To the precipitate obtained by the acidification and precipitation brought about by the action of the acetic acid on the second filtrate was also added a diluted solution of hydrogen peroxide, and the amount of oxygen evolved was very small, only traces of the gas being found. As this precipitate contained presumably all the soluble catalase found in the leaf, it was shown that the tomato leaf contained very little soluble catalase. The explanation for the greater amount liberated from the first filtrate is that the filter was so coarse that some of the pulp containing the insoluble form passed through into the filtrate, producing an energetic evolution of oxygen. The soluble form of catalase is known and is described by Loew as $\beta$ catalase.

In the normal condition the tomato leaf contains a large amount of the insoluble form and only traces of the soluble form.

After finding that catalase was present in the normal tomato leaf, a number of leaves of plants affected with the mosaic disease were treated in a similar manner, to determine whether the presence or absence of this enzyme had anything to do with this disease. The leaves of the diseased plants were treated in exactly the same manner as the leaves of the normal plants, so that there might be no chance for error due to treatment of the leaves.

Some leaves of a plant badly affected with the mosaic disease were treated in the manner previously described. In appearance the pulp and the filtrate were lighter in color than in the case of the normal plants, due probably to the fact that there was less chlorophyll in them than in the normal specimens.

When allowed to react with hydrogen peroxide ($H_2O_2$) it was found that both forms of catalase $\alpha$ and $\beta$ were present, as oxygen was evolved from the solutions in sufficient amounts to be measured.

Since it was obvious that both $\alpha$ and $\beta$ catalase were present in healthy and diseased plants, it was decided to take a weighed amount of healthy and diseased leaves and measure the oxygen evolved in a given time from a solution containing a known percentage of hydrogen peroxide. For this purpose 5 grams of healthy leaves were treated in the manner previously described, and the oxygen given off was carefully measured by an ordinary water displacement method. The soluble catalase was not precipitated, however, but the filtered juice was added in each case directly to the solution of hydrogen peroxide. The strength of solution used was as follows: —

To 120 cubic centimeters of pure distilled water was added 20 cubic centimeters of commercial hydrogen peroxide, making a solution in the proportion of 1 : 6. The pulp containing the insoluble catalase was added to this solution, and the amount of oxygen given off carefully measured. This was done both for healthy and diseased plants. The results obtained for the insoluble or $\alpha$ catalase are given below: —

*Table showing Oxygen developed by Catalase in Healthy and Diseased Leaves.*

| | Time (Minutes). | 1. | 2. | 3. | 4. | Average. |
|---|---|---|---|---|---|---|
| | | c.c. | c.c. | c.c. | c.c. | c.c. |
| Healthy leaves, . . . . | 5 | 90.00 | 165.70 | 147.30 | 87.00 | 122.50 |
| Diseased leaves, . . . | 5 | 34.75 | 80.50 | 65.48 | 21.60 | 50.58 |

From these results it may be safely stated that there is certainly a lack of insoluble catalase in leaves of the tomato which are affected with the mosaic disease.

To a watery solution of hydrogen peroxide of the same proportion as used above, *i.e.*, 1 : 6, was now added the soluble or β catalase extracted from normal and diseased plants. The results in this case indicated also that the leaves affected with mosaic disease were deficient in soluble catalase. The results obtained are tabulated below:—

*Table showing Oxygen developed by β Catalase in Healthy and Diseased Plants.*

| | Time (Minutes). | 1. | 2. | 3. | Average. |
|---|---|---|---|---|---|
| | | c.c. | c.c. | c.c. | c.c. |
| Healthy leaves, . . . . . | 50 | 26.00 | 48.30 | 33.10 | 35.80 |
| Diseased leaves, . . . . . | 50 | 14.40 | 23.70 | 27.40 | 21.80 |

The foregoing results show plainly that catalase is greatly deficient in both α and β form in leaves affected with the mosaic disease.

As catalase is possessed of the property of decomposing hydrogen peroxide, and as it is a well-established fact that hydrogen peroxide is highly injurious to plant life, and also that it may possibly be formed[1] as an intermediary step in the various metabolic changes in plant growth, it is an interesting problem to discover whether the lack of catalase is a prime factor in the production of the mosaic disease. Work along these lines will be continued, and the results announced in a future report.

## 12. SOME FACTORS WHICH UNDERLIE SUSCEPTIBILITY AND IMMUNITY TO DISEASE.

The permanent existence of any species depends upon its capacity for adapting itself to its surroundings. Health and disease in organisms are intimately associated with environment; and heat, light, moisture, plant foods, etc., are important factors. An understanding of the optimum conditions necessary for the growth of a plant is of the greatest importance as regards its normal condition of health. The close student of physiology and pathology must always have in mind the perfect type of plant, that is, one possessing perfect health, otherwise his diagnosis may be of little value, and the cause of certain unfavorable symptoms may escape his notice. In the same way that a physician can diagnose a patient's condition by an examination of certain organs, or gain an idea of the state of his general health by considering various symptoms, can one familiar with the normal functions of a plant ascertain its condition by observing certain features which it may display, and then discover the cause of the trouble.

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[1] Erlenmeyer, Berichte der deutschen Chemischen Gesellschaft, 1877. (Notes by Loew.)

The highest conception of health and vigor in plants is brought to a realization through the remarkable skill of expert gardeners, and it is no exaggeration to say that this class of men possess the most profound knowledge of a plant's requirements and limitations. Those trained men who have made a specialty of greenhouse crops for years are unexcelled in their skill and knowledge of the plant's needs, and this is also true of many intensive agriculturists. Some of these specialists have gained remarkable insight into the nature of plant reactions, the slightest change which takes place in the plant organism being noticeable to them ; but such a large percentage of this knowledge is intuitive or instinctive, as it were, that it cannot be conveyed to others. The best gardeners are in sympathy with all that pertains to the well-being of their plants, and they are continually observing each minute change which the plant may undergo, thus gaining a knowledge of the influence of the external factors which in any way affect the organism. A slight modification in the light intensity or in the temperature for even a brief period is sufficient to cause variations in the plant development which are discernible to the expert gardener. The conditions which both directly and indirectly affect a plant in respect to susceptibility to disease are various. A plant, both in its chemical and physical characteristics, is affected by light, heat, electricity, gravity and soil, moisture, air, biological relationships, etc., and in greenhouses by such factors as ventilation, air space, quality of glass, and in fact the simplest features connected with greenhouse construction. It is in a greenhouse that we gain the most insight into the relationship existing between the condition surrounding plants and their susceptibility to disease, for here the gardener has the environment largely under his control, and can therefore regulate the conditions to meet the requirements of his plants. The relation of external factors to plant diseases can be most satisfactorily studied in the greenhouse, because it is possible to modify and eliminate those which have a direct bearing upon disease, and in this way their true significance may be determined. When the conditions surrounding the plant are far from the optimum, injury and even death may follow. A stimulus which may prove beneficial under certain conditions may injure or cause the death of the organism under others; and it is only by possessing a knowledge of the optimum conditions for stimulation and by meeting the normal requirements of the plant that we can expect to obtain a perfect organism. Everything which has a bearing upon the development of the plant must be carefully considered if the perfect type is to be realized. These factors not only affect development, but have a fundamental bearing upon immunity; and if the environment can be controlled, disease can be controlled to a large extent. Even when it is not possible to modify the heat, light and moisture, as is the case out of doors, infection can be largely eliminated by making use of certain cultural practices; in fact, cultivation constitutes one of the most important factors in the control of disease.

Light affords a good illustration of the rôle a single factor may play in the configuration of plants. The physiological effect of light is to inhibit growth and to induce the formation of a firm texture of the tissue, On the other hand, lack of light stimulates growth, but plants grown in darkness are etiolated and lack firmness of tissue. There are many instances of the absence of light being responsible for serious troubles, and in others light undoubtedly exerts a detrimental influence. The tonic influence of the Bordeaux mixture in favoring the formation of chlorophyll and carbon assimilation in many plants would appear to be due to the screening or lessening of the light intensity. Sun scald, which occurs on various trees, is brought about by excessive light, as in the case with apple trees, which, when defoliated by the gypsy moth, usually die from the effects of sun scald. On the other hand, shading often causes sun scald by preventing the ripening of the wood.

There are apparently some cases, at least in greenhouses, of too intense light, or the conditions resulting from it, causing trouble to crops. In the northern latitudes many greenhouse crops do not obtain sufficient light during the winter months, and when cloudiness prevails it is with some difficulty that crops are matured without becoming diseased. All expert greenhouse men mature their crops when the weather conditions will permit, and not according to the calendar; in other words, it requires a certain definite amount of light, or so many light units, as it were, to mature a crop. The light in May, for example, is equal in intensity and amount to about twice that of corresponding periods of a day in November; consequently, it requires about twice as much time to bring a crop to the same degree of maturity in November as it would in May.

Lack of light is responsible for various mildews and leaf spots, top-burn or tip-burn, wilts, etc. Many of these leaf spots are seldom if ever found on plants to which sunlight has access. The Sclerotinia diseases of lettuce, water cress and parsley are likewise induced by crowding and shading, and light in such cases will prevent infection by the formation of resistant tissues. It is well known that absence of light causes the so-called "layering" of wheat and "damping off" of cuttings, and the mildews of various plants grown in the shade are too well known to need consideration,

The improper regulation of atmospheric moisture and ventilation is responsible for many fungous diseases, and the control of these factors is important in preventing the troubles. Among the mildews, Cladosporium can be entirely controlled by holding the moisture in the greenhouse in check, and by paying strict attention to proper ventilation and to normal light conditions. Many gardeners have succeeded in controlling the chrysanthemum rust by using proper precautions in regard to moisture.

A series of the most troublesome diseases common to cucumbers and melons out of doors — Plasmopara, Alternaria and Anthracnose — can be absolutely controlled in the greenhouse by paying attention to moisture, light and ventilation. The circulation of air, as well as light, has a marked effect upon the development of resistant tissues in greenhouse crops, and the control of moisture is necessary to prevent the germination of various spores which are likely to infect crops. It is well known that the tops of trees are less likely to become infected by fungi, owing to the smaller amount of moisture there than about the branches nearer the ground; and asparagus plants when grown under trees or covers which protect them from the dew seldom show any indications of rust.

Too great a degree of heat and moisture in the soil gives rise to serious troubles, as may be seen in the case of Œdema of tomatoes; and when seedlings are grown in soil that is kept too moist and at too high a temperature, they are likely to "damp off." The presence of water in a plant in excess of certain amounts is favorable to disease, as is shown in the carnation's susceptibility to rust; for example, those carnation plants possessing the greatest amount of water in their tissues appear to be the most susceptible to rust. The stimulating effects of electricity, fertilizer and sterilized soil often prove injurious by developing too high a water content in the tissues, thus rendering them more susceptible to disease. Tillage, manuring, irrigation, mulching, etc., are important factors in securing vigorous plants, and go a long way towards rendering them immune to certain diseases. An excessive amount of moisture in the soil stimulates growth and often renders plants more susceptible to fungous diseases, and a lack of water has the same effect; in fact, stimulation of various sorts may result in weakening a plant and rendering it less immune to disease.

The life history of an organism presents different stages of susceptibility or immunity to disease, corresponding to different stages of development; for example, young plants may be more susceptible to certain diseases than older ones. Very young seedlings often fall a prey to the "damping off" fungus, but when they have reached a certain stage of development they become immune to fungi, and the younger and less-developed parts of mature plants are more susceptible than the older parts. Vegetative rest and overmaturity are also favorable to disease, while the conditions associated with isolation are unfavorable for infection. Weakened plants are more susceptible to disease than strong ones, and in most cases, if not all, vital depressions are the real causes of disease. Vital depressions are brought about by the abnormal conditions which modify and reduce the power of resistance, consequently the organism falls a prey to the ever-present germ.

The causes underlying susceptibility are much better understood than those of immunity. Why it is that the moment a plant becomes weakened various organisms attack it, is not fully understood. We have observed many instances of certain treatments weakening plants, and as a result it is surprising to note the number of organisms which always attack the plant a very short time afterwards. The changes which actually take place in an organism in a depressed condition are not known, but many of these may be of an abnormal chemical nature. It is possible that these abnormal chemical changes stimulate organisms to attack weakened plants; that is, the loss of immunity increases the susceptibility of the organism to disease, due to vital depressions in the plant, which may result in the giving off of substances that act as a stimulus and attraction to invading organisms. Briefly stated, susceptibility to disease may be associated with chemotactic irritability.

Some crops are probably rendered more susceptible to fungous diseases by cultivation. The limitations of forcing have undoubtedly been overstepped in some cases, and this is especially true of the carnation, which has been much troubled with the wet and dry stem rots since the modern methods of forcing have come into vogue.

In the case of outdoor crops, great differences exist in the environment, due to climatic influences. The conditions may be such that a disease constantly causes loss in one locality and scarcely any in another; and, while it may be necessary to spray for a trouble in one State, in others no attention need be given it. No doubt in some instances it would be wiser to devote one's energies to cultivation, as a means of preventing plant diseases, than to resort to the use of fungicides. Our most skilled agriculturists, such as florists and market gardeners, seldom if ever resort to spraying, and in greenhouse culture the use of fungicides is practically unknown. Certain crops are greatly benefited by being sprayed with fungicides; but, on the other hand, there are crops which have been sprayed for many years with little or no benefit as far as the control of pathogenic fungi is concerned, and the money spent for spraying would in such instances be more wisely used in methods of cultivation. Some of our best landscape gardeners have advocated that, if $25 were to be used in planting a tree, about $23.50 of it should be used for preparation; and such advice is based upon the best agricultural practices. If intensive agricultural methods were applied more often to the growing of plants, pathologists would have much less diagnosing of diseases to do.

Every influence which may in any way affect plants should be carefully studied. We should understand what influence the chemical, physical and biological properties of soil, manures, fertilizers, air drainage, etc., have upon susceptibility to disease. The plant organism is an extremely complex mechanism, very plastic and responsive, and is continually being acted upon by a number of forces or stimuli which in turn produce a series of self-regulatory and correlative reactions. Undoubtedly in the future the control of plant diseases will depend more upon breeding and cultural conditions than now; but for the present, spraying must be employed when practicable for the control of diseases until something better shall have been discovered.

# REPORT OF THE ENTOMOLOGISTS.

C. H. FERNALD; H. T. FERNALD; J. N. SUMMERS.

## Outline of Work.

The four divisions into which the entomological work of the experiment station is naturally divided — correspondence, experimental investigations, special research and publication — have each received their share of attention during the past year.

The correspondence has been as large in amount as heretofore. Many inquiries about many kinds of insects have been received and answered as fully as possible: and in this connection the printing of a number of circulars, treating of the insects most frequently asked about, has greatly facilitated the work, as a circular can be sent in a small fraction of the time necessary to write out the same information, besides giving an opportunity to send illustrations of the insects and of their work.

Experimental investigations during the year have been along numerous lines. Determinations of the resistance of different crops to fumigation with hydrocyanic acid gas have been continued, and are now complete for the cucumber, and similar tests for muskmelons are under way.

An extensive series of tests of different methods for the control of cabbage, turnip and onion maggots was also begun. The cabbages, being the first crop on which treatment was possible, were experimented with in nine different ways. Unfortunately, it soon became evident that no treatment of any kind would be needed, almost no maggots being present either in the check rows or in the field anywhere, so that the only data of any value which could be obtained were those relative to the cost of different materials and the ease with which they were applied, leaving the question of their relative efficiency for subsequent determination in other seasons.

Observations on the dates of appearance of the oyster-shell, scurfy and white pine scales have been made as usual, and should be continued for a number of years, to obtain reliable averages for use in spraying. Observations on the number of broods of the codling moth have also been continued, and a more extensive series of experiments with this pest is now being planned for next season.

In 1906 the "blight" caused a large monetary loss in the Connecticut River valley on the onion crop, and as this is caused by a thrips, studies of the best methods of controlling this pest were undertaken in co-operation with several large onion growers. The main difficulty in this work seems to be to devise a machine which will spray a number of rows at once in a sufficiently thorough manner to destroy most of the insects. This problem is now being worked upon, and with good prospects of success.

The number of new mixtures produced for use against the San José scale has necessitated many tests of these materials, some of which seem quite effective, though expensive, while others apparently are of no value. Thus far nothing tested at this station which is reasonable in cost has excelled the lime and sulfur wash, though a few trials of one substance are quite promising, and these will be continued during the spring of 1908.

Investigations on the work of cranberry insects and the best methods for controlling them have been continued in charge of a special investigator located at Wareham, and it is hoped to publish the results of this work soon as a bulletin. At the request of the Cranberry Growers' Association, sets of cranberry insects and samples of their work are being prepared, to be placed in different parts of the cranberry-growing region, where they will be most easily accessible for examination by growers.

During the summer the life history of the oriental moth was carefully studied, and all stages of its existence were described and photographed. In addition, a study was made of the local conditions where it occurs, and it was found that the limits of its distribution, as already published, though approximately correct, are not entirely so, the insect having been found in one or two directions beyond those limits. In most of the infested territory the brown-tail moth is abundant, and spraying with arsenate of lead was very general in that region last summer. The result was also to destroy large numbers of the larvæ of the oriental moth, the treatment being so effective that in August it was hard to find any of the caterpillars without making a prolonged search.

These facts indicate that this insect is not likely to become a serious pest. If it should become well established, however, in some locality where no attention is paid to insect pests, it is possible that it might cause considerable injury ; but in such a case it is probable that a single thorough treatment there would be effective for several years. The Japanese name "ira-mushi," for this insect means "the nettle insect," and during the summer several reports of the nettling caused by the spines of the caterpillars were received, indicating that, if this insect should at any time become very abundant in an inhabited locality, the residents there might suffer some inconvenience from its presence.

Massachusetts is close to the northern limit of the distribution of some insect pests and near the southern limit of others. It seems probable that for some of these there are portions of the State where these pests may be of importance, while in others they will require no attention. It is important that the exact facts in this regard should be determined, and researches have been begun to ascertain the localities in which comparative immunity from certain pests may be expected. To obtain definite results on this subject will be the work of several years and much correspondence, but it is hoped that when they are obtained, directions can be prepared which will guide towns in different localities in making their annual appropriations for the protection of their trees, which will save many thousands of dollars.

Three bulletins on insects (Nos. 114, 115 and 116) have been published during the year, besides numerous circulars already referred to, these last being used only in answering correspondence. In addition, a number of other articles too brief for bulletin material or not adapted for a publication of this nature have appeared elsewhere, and several more are nearly ready for the printer.

## INSECTS OF THE YEAR.

The year 1907 has brought many inquiries about different insects. As heretofore, however, the San José scale has been most prominent in the correspondence, followed closely by the oyster-shell scale, plant lice, — particularly the woolly apple louse, — the codling moth, the plum curculio as an apple pest, the elm-leaf beetle and the apple maggot or railroad worm.

The elm-leaf beetle, after several years of comparative unimportance, is again becoming a serious pest. In 1900 and 1901 it caused much injury in the Connecticut valley and in eastern Massachusetts, and in 1902 its work was also very noticeable. In the spring of 1903 the beetles were abundant, large numbers of egg clusters were found, and there was every promise of another year of serious injury. During May and June, however, there was a drought so marked that grass dried in the fields and the leaves of the elms became hard and tough and many fell off. It was noticed that many of the egg clusters of the elm-leaf beetle failed to hatch under these conditions, and that the young larvæ in many other cases seemed unable to bite into the tough, dry leaves, so that the work of this insect in 1903 was unimportant. The following winter was unusually severe, but whether this was also a factor in the result cannot be stated. Whatever the cause, however, few elm-leaf beetles were present in 1904, 1905 and 1906, though in the year last named they were increasing in abundance; but last summer (1907) they had become quite plentiful, at least in certain localities, and it is probable that they will be as injurious as formerly in a year or two, unless climatic factors again cause their destruction.

Just how far the drought of 1903 was responsible for the destruction of these insects it is of course impossible to say; but the abundance of unhatched egg clusters and the evident struggles of the tiny grubs to break through the unusually toughened epidermis of the leaves during that period are very suggestive.

The appearance of the leopard moth (*Zeuzera pyrina*) in and around Boston during the past year adds another important insect to the list of pests with which Massachusetts must deal. This insect has been quite abundant around New York City for some years, but has not been reported from this State. As a borer in shade trees it is a serious pest, and its presence must hereafter be taken into consideration by our city foresters and tree wardens.

The brown-tail moth has continued to spread over the State, but in those localities where it has been longest present it seems to be becoming less serious and more generally attacked by disease. Whether this condition will be permanent or is only temporary cannot be determined now, but its permanency is greatly to be desired.

The presence of the San José scale in the Housatonic valley has been suspected for several years, simply because there seemed to be no reason why it should not be present there. Specimens of this scale from several localities in this region, received during the past season, demonstrate its presence there, leaving only the higher parts of the Berkshire hills and the northwestern corner of the State as localities from which it has not as yet been reported, and time will probably add these portions of the State to the list of infested regions.

The marked decrease in abundance of root maggots and cut worms this year should be noted, while the spruce gall louse, squash bug and several kinds of caterpillars, all common pests, appear to have been unusually abundant; but on the whole the year has been without a serious insect outbreak of any kind.

# REPORT OF THE VETERINARIAN.

JAS. B. PAIGE, D.V.S.

## OUTLINE OF WORK.

The work in the veterinary department of the station naturally falls under one of the following divisions: correspondence, examination of specimens, and original investigations. These merge so much one with the other that they are by no means as distinct as the divisions would seem to indicate. It not infrequently happens that through correspondence attention is called to the existence of a peculiar disease among farm animals. Specimens are asked for, and forwarded for examination, which sometimes afford material for original investigations.

## CORRESPONDENCE.

During the past year letters have come to hand from people in every part of the State, asking for information regarding the sickness of individual animals, or perhaps regarding a disease that has appeared in a herd or flock, affecting many animals. Of necessity it is impossible to make a correct diagnosis in every such instance, from the description of the case as detailed by the correspondent. In other instances the symptoms are so accurately given and of such a character as to enable one to diagnose the case with certainty, and advise a specific course of treatment. The correspondence work carried on with those living in rural sections, where no qualified veterinarian is accessible, has proven of such benefit to the farmers as to warrant its continuance, notwithstanding the difficulties that are encountered in arriving at definite conclusions as to diagnosis and treatment. When it is impossible to give definite directions for the treatment of an individual animal, it is possible from the symptoms enumerated to recommend a line of treatment, or general directions can be given which when carried out make it possible for the stock owner to pursue such a course as to prevent the spread of the disease to other animals exposed, or to prevent its recurrence.

## Examination of Specimens and Original Investigations.

For many years it has been the practice of the veterinarian of the college to examine material from sick or dead animals, and to report the findings to the one sending the specimen, and advise a line of treatment for the individual animal or protection of the remaining animals of the flock or herd.

From an examination of such specimens as have been sent in during the past year, a diagnosis has been made of nodular disease of sheep, caused by the parasite œsophagostoma Columbianum, enterohepatitis of turkeys, verminous bronchitis of sheep, fowl cholera, swine plague and other more common diseases of a less serious nature. Through correspondence and the sending of specimens a very interesting and quite uncommon disease of poultry in this country was brought to the attention of the department.

In January of the present year there arrived at the department by express a dead fowl, which upon post-mortem examination exhibited some of the lesions of European fowl cholera. Microscopic examination gave support to that diagnosis. To confirm the same, a pigeon was inoculated with a small quantity of blood from the heart of the dead fowl. After the lapse of about twelve hours the inoculated pigeon was found dead. A microscopic examination, together with culture tests, demonstrated the presence of the fowl cholera organism in the blood. Subsequent inoculations and examinations gave similar results.

Considering the seriousness of the disease, its rare occurrence in this State, together with the possibilities of its rapid distribution among flocks of poultry, through sale of birds and otherwise, a visit was made to the farm from which the specimen had come.

It was found that about two hundred birds were kept by the poultryman, in two different flocks situated some fifty feet apart. About one-half of the fowls had been raised upon the farm the previous summer. The remainder of the flock, consisting of fowls and chicks, had been purchased of a dealer in live poultry the previous November. At this time all the birds raised and purchased seemed to be in perfect health. The history of the outbreak is briefly as follows: —

About Jan. 1, 1907, one morning the poultryman found, upon going into the house containing the purchased stock, a dead bird upon the dropping board. No sick fowls had been noticed the day previous. During the next two weeks several dead birds were found under conditions similar to the first. Few or no fowls of the flock exhibited symptoms of sickness at any time during the existence of the trouble. The loss continued, however, up to the middle of January, when the specimen was sent to the station. The total loss amounted to about twenty per cent. of the entire flock. One morning three dead birds were found under the roosts. At no time did the disease appear among the fowls raised upon the farm. This is probably to be accounted for by the fact that the infectious material was brought on to the place by the purchased stock, and that the two flocks were kept entirely separate. As soon as a diagnosis of the disease had been made, the poultryman was advised of the contagiousness and seriousness of it, and the possibilities of its spreading to other flocks in the neighborhood. He showed a willingness to do all in his power to eradicate the disease as soon as possible. At an early date all the remaining birds in the infected house were destroyed, the house thoroughly cleaned, fumigated and sprayed with a disinfectant solution. The treatment was so heroic and so faithfully carried out that there has been, so far as known, no recurrence of the trouble.

On April 18, 1907, a dead fowl from a farm on the opposite side of the street to the one where fowl cholera had existed was sent to the station.

An autopsy, supplemented by inoculation experiments and microscopic examinations, resulted in a diagnosis of fowl cholera, identical in every respect with that found to exist in the fowls kept on the adjoining farm. There were from four to five hundred birds on the place. A part had been raised on the farm, a part purchased of itinerant dealers in live poultry. The fowls were divided into two lots. About one hundred had the run of a large, dry, open barn cellar; the remainder were kept in a single long poultry house, divided into sections with partitions of wire netting. Both lots were allowed free range, all mingling together in one flock during the day.

It was learned from the owner on April 27 that the two weeks preceding the date of sending the dead fowls to the station (April 18), between fifty and sixty fowls, a part from each flock, had died very suddenly. It was also learned that during the winter of 1906 about one hundred and twenty-five birds had died from flocks kept in the poultry house and barn cellar during that winter. No cause was found to account for this large mortality. Taking into account the history of the case and the symptoms exhibited by the birds as given by the owner, it seems probable that the loss in 1906 was also due to fowl cholera. There is no positive proof that this was the case.

It was reported by the owner of the flock in question that his birds frequently came in contact with fowls kept on the opposite side of the street, and that individuals from both flocks ranged over the same ground.

In dealing with the last and larger flock, circumstances did not seem to warrant the application of the line of drastic treatment that had been carried out with the flock dealt with earlier in the year. Deaths had occurred among fowls kept in the poultry house and in the barn cellar; all had run together, when the weather permitted their being outside the buildings, and it seemed certain that the infection had become widely spread about all parts of the farm in the immediate vicinity of the buildings.

To arrest the spread of the disease, the owner was advised to thoroughly clean all parts of the buildings with which the fowls had come in contact, including a removal of the surface soil from the barn cellar and pens in the poultry house. He was further advised to follow this cleaning with a liberal application of a coal tar disinfectant and a fresh lime whitewash. As a further precaution against the spread of the infection through the medium of food and water contaminated with infectious fecal matter, specially constructed automatic feed boxes and drinking fountains were recommended. In addition, it was suggested that from five to ten grains of permanganate of potash be added to each gallon of drinking water, the water to be supplied fresh twice daily, and kept as free as possible from organic matter, which destroys the antiseptic properties of the potash salt. These measures, supplemented by frequent cleaning of houses, disinfection of fæces, etc., seem to have completely stamped out the disease, as nothing has been learned of its recurrence.

Judging from the reports that have been made of the few previous outbreaks of fowl cholera that have occurred in this country, it would seem that the two in question have been of a mild type, for in each outbreak previously reported the spread of the disease has been much more rapid and the mortality greater, amounting in some instances to one hundred per cent., as is frequently the case with the outbreaks in Europe. The successful treatment adopted in dealing with the second case, which consisted of mild measures, also tend to show that the disease was not of that virulent nature frequently met with.

Considering the few outbreaks of fowl cholera that have occurred in this country, and the benefit to be gained from knowing the source of the infection in combating this disease, it is to be regretted that the source of the contagion in the cases under consideration could not have been determined. It seems fair to conclude that it must have been introduced on one of the farms through some of the fowls purchased of the traveling dealers in live poultry.

Another interesting and, so far as can be determined, new disease for poultry was brought to the attention of the department through a communication from a poultryman on the Cape in the summer of 1906. An investigation of the disease was begun on June 27 of that year and concluded in October of the present year. During this time a series of experiments have been carried on at the college in conjunction with those conducted at the farm.

The part of the farm given up to poultry culture consisted in the main of a sand plain. A portion on which the chicks were kept consisted of pure white quartz sand, and was devoid of vegetation except for an occasional weed growing upon it. This locality had many years previously been the site of salt works.

The present owner had built upon this location a poultry plant with a capacity sufficient to handle from fifteen hundred to two thousand birds. This plant consisted of poultry houses, incubator cellar, brooder houses, coops, etc. Everything about the place, including equipment, was of the latest pattern and of modern construction. The practice was to hatch chickens in incubators and brood them under hens and in brooders. The hens with chicks were kept in coops placed some distance apart in yards. Several small yards were fenced off with wire netting, each of which contained a brooder of sufficient size to accommodate from fifty to seventy-five chicks. The disease never made its appearance among any of the adult fowls or any of the young chicks except those brooded in brooders. Those kept with hens in individual coops never contracted the trouble. The mortality among the brooder chicks usually ranged from ninety to one hundred per cent. The loss of from three to five hundred in a season was not an uncommon occurrence. It was extremely rare that a chick once attacked ever recovered. In some lots a few escaped contracting the disease, while others of the same lot succumbed to it. It usually attacked chicks at the age of three weeks, although those older or younger than this were not exempt.

The first appearance of the trouble was characterized by the development of large serous or water blisters on the front and upper parts of the featherless portions of the legs and feet. After a period of twenty-four to forty-eight hours the blisters would rupture and the serum escape. Frequently the affected parts would be rubbed with the head, and as a result the featherless parts of the head would become affected in a similar manner to the feet and legs. An extension of the disease about the head invariably led to an affection of the eyelids, which would become fastened together by the sticky exudate. The ball of the eye was not involved. In some instances the head would first become affected, later the feet and legs. Occasionally it was found that the head or the feet alone would be the only part involved. So far as known, the posterior part of the leg or parts of the body covered with feathers never became affected. After rupture of the blisters and escape of their contents the surface skin became dry and shriveled, after a time becoming detached, leaving behind the moist underlying vascular tissues. These soon become covered with soil and encrustations of tissue and serum. Forced removal of these crusts was followed by capillary hemorrhage and the formation of new crusts. A shedding of the crusts frequently occurred as the disease advanced. As a final result, all parts of the soft tissue of the feet were destroyed or modified to such an extent that the toes became bent upward, and the foot deformed so that only the ball of the foot would come in contact with the ground when walking was attempted. In addition to the local lesions, there were symptons indicating a considerable degree of constitutional disturbance. Nutrition seemed at a standstill. Growth was arrested, although there was a disposition to eat and drink. The closing of the eyelids often made it impossible for the chicks to take food or water, even though they were disposed to do so. When the lids were separated the birds usually ate and drank ravenously until they became filled.

Numerous remedies had been employed for the treatment and prevention of the trouble, but to no avail. The disease made its appearance in each lot of chicks shortly after they were placed in the brooders.

It was the opinion of the poultryman that the soil contained some poisonous irritating substance that was accountable for the trouble. Why it should appear in brooder chicks and not among those brooded under hens he was not able to explain. To settle this matter a sample of soil was submitted to chemical analysis, but nothing of an irritating or poisonous nature was found.

The general course and character of the disease seemed to indicate that it was the result of the local action of something. It was suspected that it might be due to the heat from exposure to direct sunlight. Experiments were made upon chicks by the use of a lens to concentrate the sun's rays upon the legs and feet, and it was found possible to produce upon experimental chicks lesions identical with those found upon chicks brought from the yards, even to the extent of producing a slight deformity of the toes, due to the contraction of the tendons and the cicatricial tissue. An attempt was made to rear feathered-legged varieties of chicks upon the same ground where there had been the greatest mortality, but owing to some mishap in connection with the incubation of the eggs, the work along this line was not completed. It is hoped to carry out this detail at a later date.

As a practical remedy for the trouble this poultryman has had to contend with, it was suggested that all chicks be removed to and raised upon an adjoining piece of ground sufficiently fertile to support vegetation, that would protect the featherless and tender portions of the body from the heat of the sun.

During the past summer this suggestion has been complied with, with the result, to quote the owner's own words, under date of Oct. 4, 1907: "That so far this season I have not had a single case of sore head or feet, such as you know of, among my chicks."

At present a series of experiments is being carried on to determine the effect of poisons, used in tree-spraying work, upon animals consuming forage grown beneath the trees.

# REPORT OF THE METEOROLOGIST.

J. E. OSTRANDER.

In meteorology, where the work is in a large degree essentially that of observation and tabulation, the records must be continued from year to year without material change, if the results are to be of value for the purposes of comparison. As the length of time covered by the records increases, the data become more valuable, and the mean climatological conditions can be determined with constantly increasing accuracy.

During the past year the work of this division has been a continuation of that of previous years, and no material modification has been made. Although efforts are constantly made to increase the precision of the records, the general form and range remain unchanged.

The semi-daily observations, at 8 A.M. and 8 P.M., have been taken regularly, and the results transcribed in the permanent record book. Many records from the self-registering instruments have also been entered, to keep them compact and accessible. The usual monthly bulletins, giving much of these data, have been printed on the first of each month. These are now mailed from the director's office instead of from the printing office as heretofore, which involves a little loss in promptness of distribution. The December bulletin will contain a summary for the year, instead of the usual remarks.

The local forecasts have been received by telegraph from the section director of the United States Weather Bureau, at Boston, and the signals displayed from the flagstaff on the tower. This division has co-operated with the section director in furnishing the usual voluntary observer's reports for each month, and the snow reports during the winter season. The horticultural division has consented to keep a phenological record during the growing season for the use of this division, and a copy is furnished the section director at Boston.

The old thermometer shelter on the campus has been replaced by a larger and more convenient one, and an underground lead-covered cable placed for the purpose of providing an electric light in the shelter. A second underground cable is in place for connecting the tipping-bucket rain gauge with the recording instrument in the tower. A specially designed cover for the man-hole of the heating system, which is near the rain gauge, has been secured. It is proposed to place the rain gauge on this cover in such a manner that the heat from the man-hole will melt the snow which falls in the gauge, and thus furnish a precise record of the time of the beginning and ending of snowstorms.

A maximum thermometer of standard pattern is the only addition to the instruments made during the year.

No change in the personnel of the observers has been made during the year.

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